

SECTION 1

INTRODUCTION

1.1. Background

The 1980 amendments to the Resource Conservation and Recovery Act (RCRA) created an exemption to the federal hazardous waste program for oil and gas exploration and production (E&P) wastes pending completion of a study by the U.S. Environmental Protection Agency (EPA). In 1988, EPA completed its study and determined that these wastes should not be regulated as hazardous wastes. EPA's regulatory determination concluded that existing state and federal regulations were generally adequate, but that some regulatory gaps existed and that enforcement of existing regulations was inconsistent. EPA proposed a three-pronged approach to address these concerns that included working with the states to encourage improvement in state regulations and enforcement programs. Further discussion of the regulatory determination follows in section 1.2.

In 1989, the Interstate Oil and Gas Compact Commission ("IOGCC") responded by offering to assist EPA by creating a state regulatory review process. The IOGCC created the Council on Regulatory Needs, bringing together state, environmental, and industry representatives to develop national guidelines for state oil and gas programs. In early 1990, the Council released a document entitled "EPA/IOCC Study of State Regulation of Oil and Gas Exploration and Production Waste". This document established guidelines that represented recommended criteria for regulatory programs. The Council also proposed to implement a process by which state oil and gas programs were reviewed in comparison with those guidelines.

In 1990, EPA provided a grant to the IOGCC to initiate state regulatory program reviews in comparison with the guidelines. Review teams were comprised of state regulatory officials, environmental representatives, and industry representatives. Representatives of other interested parties, such as federal agencies and tribal governments, were invited to observe the process. State reviews were conducted in states that volunteered for review. Recommendations were offered as blueprints for change to be considered by state legislators and regulators.

The Council recommended that the guidelines be reviewed and updated every three years. In 1994, the Council updated the guidelines and

added sections regarding naturally occurring radioactive material (NORM) and abandoned wells.

In 1998, a multi-stakeholder organization was formed by the state review program participants to revitalize and carry the state review program forward. This new organization is called State Review of Oil and Natural Gas Environmental Regulations, Inc. ("STRONGER"). STRONGER is a non-profit corporation that has been specifically formed to educate regulators and the public as to the appropriate elements of a state oil and gas exploration and production waste management regulatory program, and to compare various state programs against the guidelines developed by STRONGER and accepted by the IOGCC for the protection of public health, safety and the environment.

In 1998, STRONGER established five committees to review and update the 1994 version of the guidelines. STRONGER incorporated the consensus recommendations of the committees in the 2000 Guidelines update, which were reviewed by the IOGCC in draft, revised, and accepted by the IOGCC member states. STRONGER again initiated revision and updating of the Guidelines in 2004, which resulted in these 2005 Guidelines.

Since 1990, 28 initial and follow-up state reviews have been conducted against the guideline standards; 12 under the 1990 guidelines, 5 under the 1994 revised guidelines, and 11 under the 2000 Guidelines. These states represent over 90% of all domestic, onshore oil and gas production. The states have implemented many of the recommended improvements, as documented in IOGCC's report entitled "State Actions Based on State Review Process Recommendations" (May, 1998).

1.2. EPA's Regulatory Determination for E&P Waste

The 1980 amendments to the RCRA required EPA to conduct a study of the environmental and potential human health impacts associated with E&P wastes and their associated waste management practices. EPA completed its two-year study in 1987. Based on the findings in the Report to Congress, and on oral and written comments received during public hearings in the spring of 1988, on June 30, 1988, EPA decided not to recommend federal regulation of E&P wastes as hazardous wastes under Subtitle C of RCRA (EPA 1988). The Agency gave the following reasons for its determination:

- a. "Subtitle C does not provide sufficient flexibility to consider costs and avoid the serious economic impacts that regulation would create for the industry's exploration and production operations;
- b. "Existing state and federal regulatory programs are generally adequate for controlling oil, gas, and geothermal wastes. Regulatory gaps in the Clean Water Act and UIC (Underground Injection Control) program are already being addressed, and the remaining gaps in state and federal regulatory programs can be effectively addressed by formulating requirements under Subtitle D of RCRA and by working with the States;
- c. "Permitting delays would hinder new facilities, disrupting the search for new oil and gas deposits;
- d. "Subtitle C regulation of these wastes could severely strain existing Subtitle C facility capacity;
- e. "It is impractical and inefficient to implement Subtitle C for all or some of these wastes because of the disruption and, in some cases, duplication of state authorities that administer programs through organizational structures tailored to the oil and gas industry; and
- f. "It is impractical and inefficient to implement Subtitle C for all or some of these wastes because of the permitting burden that the regulatory agencies would incur if even a small percentage of these sites were considered Treatment, Storage, and Disposal Facilities (TSDFs)." (53 FR 25456, July 6, 1988).

In the determination, EPA found that "existing state and federal regulations are generally adequate...Certain regulatory gaps do exist and enforcement of existing regulation in some states is inadequate." To address those concerns, EPA announced a three-pronged approach that consists of:

- "Improving federal programs under existing statutory authorities in RCRA Subtitle D, the Clean Water Act, and the Safe Drinking Water Act;
- "Working with states to encourage improvements in the states' regulations and enforcement of existing programs; and
- "Working with Congress to develop any additional statutory authority that may be required."

1.3. State and Federal Relations

Periodic evaluations of state and federal E&P waste management programs have proven useful in improving the effectiveness of those programs and increasing cooperation between federal and state regulatory agencies. Stakeholder review mechanisms have demonstrated the need for establishment of a performance baseline against which E&P waste management programs can be evaluated. Those mechanisms have led to the identification of strategies that will improve communication and program understanding between the states and the federal government.

1.3.1 Strategies for Maintaining a Successful Relationship Between State and Federal Agencies

As stated in EPA's regulatory determination for E&P waste, "...existing state and federal regulations are generally adequate to control the management of oil and gas wastes. Certain regulatory gaps do exist, however, and enforcement of existing regulations in some states is inadequate." The key is that overall state programs are adequate, and have improved since 1990 through adoption of recommendations from reviews, information sharing among the states and self-initiated program improvements. To address remaining gaps and build upon the success of the state review program, the focus of future efforts should be to utilize information developed from the reviews already conducted, augmented by new information developed by the stakeholders, to improve the performance of state regulatory programs.

The stakeholders — oil and gas producing states, public interest representatives, and industry representatives — have identified ten related strategies that enhance state and federal relations and promote effective management of oil and gas wastes.

a. Commitment to Work Cooperatively. The states and federal agencies should maintain a commitment to work cooperatively to improve the design, implementation, and enforcement of state and federal programs for managing E&P wastes. State and federal agencies should take steps to encourage open communications among state and federal agencies, the regulated industry, and other interested parties pertaining to the management and regulation of E&P wastes.

b. Recognition of Different Priorities. States should recognize the

interest of federal agencies in achieving national goals and objectives and assuring adherence to federal statutory and regulatory requirements. At the same time, federal agencies should recognize the authorities, responsibilities, and capabilities of states to regulate certain activities within their borders.

- c. **Recognition of Different Statutory Objectives.** Several of the federal statutes governing protection of the environment (*e.g.*, RCRA, Clean Water Act (CWA), Safe Drinking Water Act (SDWA)) provide for state implementation of certain elements with federal oversight. The objectives of and authorities granted by each statute differ. As such, it should be recognized that federal and state authorities and implementation approaches may differ.
- d. **Recognition of Regional Diversity.** As discussed in the Report to Congress and the legislative history of the SDWA, variable approaches to the management of E&P wastes are necessary. These variable approaches are partly a result of the different geologic, hydrologic, or historic conditions in states and areas within a state, the diverse characteristics of oil and gas activities, and differences in state government structures among the producing states. Guidelines or criteria, whether issued by a federal agency such as EPA or as advocated by the IOGCC and STRONGER, should be sufficiently flexible to permit states to take into account these varying conditions.
- e. **Baseline of Performance.** The criteria adopted by IOGCC and STRONGER should be used by federal or state agencies that are responsible for any portion of an E&P waste management program. These criteria should serve as a baseline of performance by which the effectiveness of programs can be judged. The criteria provide states flexibility to address unique conditions while accomplishing the goals set forth in Section 3.
- f. **State Responsibility for Enforcement.** Enforcement is a critical component of a state E&P waste management program. Federal government involvement should occur only if the state agency fails to enforce the requirements or requests federal assistance.
- g. **State Program Review Process.** The state program review process should continue to provide states with an independent evaluation of their E&P waste management programs using criteria adopted by the IOGCC and STRONGER.

- h. Resolving Conflicts/Building Consensus.** Where there are unresolved national issues or concerns regarding E&P waste management, a task force should be created which is similar in makeup and form to that established for the EPA's Office of Drinking Water Mid-Course Evaluation of Class II UIC programs. The creation of this task force would bring knowledgeable federal and state regulators together to discuss issues, to ascertain whether problems associated with these issues are real or perceived, and to decide how best to address the issues. This process should be based on the best available information and could be initiated by either the federal government or the states.
- i. Effective Multi-Agency Coordination.** Coordination among the state agencies is addressed in more detail in section 4.4. However, each state should recognize that coordination among various agencies is necessary for building and maintaining trust between the state agencies and the federal agency that has oversight responsibilities.
- j. Technical and Financial Assistance.** The federal government should provide technical and financial assistance to states to improve the design, implementation, and enforcement of state E&P waste management programs. Such assistance may be in the areas of training, enforcement, and data management.

SECTION 2

SCOPE OF THE CRITERIA

2.1. General

- a. These criteria are intended to guide states in assessing and improving their regulatory programs for E&P waste management. This document, therefore, sets out the elements of an effective program using "should" rather than the mandatory "shall", and "are encouraged to" for elements which are desirable, but which are not necessary for an effective program.
- b. These criteria address waste management practices that are unique to E&P operations and wastes that were determined by EPA to be exempt from the hazardous waste management requirements of Subtitle C of RCRA. These narrowly defined wastes include drilling muds and cuttings, produced water and other wastes associated with E&P activities. The chemical and radiological characteristics of these wastes and the management practices associated with the storage, treatment, and disposal of these wastes are covered by these criteria. Wastes that are uniformly regulated by RCRA hazardous waste management requirements, as well as general industrial wastes such as solvents, off-specification chemicals, commercial products, household wastes, and office refuse are not addressed by these criteria.
- c. These criteria apply to all new and currently operating E&P waste management facilities. In addition, the criteria in Section 6 apply to abandoned sites.
- d. These criteria do not address disposal of E&P wastes by injection or surface discharge when those waste management practices are regulated by EPA or by the states under authority of the federal SDWA and federal CWA, respectively. Brief descriptions of the regulatory frameworks authorized by those laws follow in Sections 2.2. and 2.3.
- e. In addition to a review of provisions of the SDWA and CWA that are applicable to E&P wastes, this section also contains federal definitions of solid wastes and hazardous wastes and reviews EPA's waste mixture rule; lists examples of exempt and non-exempt E&P wastes; and describes general requirements for the management of

non-exempt wastes. States may have different definitions for solid and hazardous wastes.

- f. It is recognized that portions of these criteria address areas other than E&P waste management practices, such as some tanks at enhanced oil recovery operations.

2.2. Class II Injection Wells

The SDWA is the primary federal statute that governs injection wells. The SDWA required the EPA to promulgate regulations to protect drinking water sources from contamination through underground injection, but directed the Agency not to prescribe requirements which would impede oil and gas production. EPA established five classes of injection wells, categorized by purpose, potential for endangering drinking water, depth of injection, and characteristics of their injectate quality. Class II injection wells are broadly defined as related to oil and gas injection activities. Activities in this class relate to the disposal of fluids associated with oil and gas exploration and production, enhanced recovery operations, and the storage of liquid hydrocarbons.

Enhanced recovery describes all efforts to increase ultimate production of oil and gas from a reservoir, and this terminology will be considered to encompass other nomenclature in common usage such as pressure maintenance, secondary recovery, and tertiary recovery. All enhanced recovery techniques include methods for supplementing natural reservoir forces and energy, or otherwise increasing ultimate recovery. Such techniques include water injection, gas injection, gas cycling, and miscible chemicals and thermal processes.

Class II UIC programs are administered by the States where EPA has approved primary enforcement authority (primacy), or are directly implemented by EPA where the States have not sought or received approval for their UIC program. Amendments to the SDWA in 1980 further allowed a State with an existing regulatory program to obtain primary enforcement authority from EPA as long as the State was able to demonstrate that its program was effective in protecting underground sources of drinking water (USDWs), rather than adopting the complete set of Federal requirements. States with UIC program primacy receive federal funding for program implementation.

In general, EPA determines which fluids may be injected into Class II wells in direct implementation UIC programs. Primacy States follow their EPA-approved primacy agreements in ascertaining whether specific

fluids are qualified for injection into their Class II wells.

Among the minimum requirements for Class II wells are:

- a. Only approved fluids may be injected,
- b. No injection may endanger a USDW,
- c. No well may be used for injection without a permit, unless authorized by rule.
- d. All injection wells must demonstrate mechanical integrity at least once every 5 years.

2.3. NPDES-Permitted Discharges

All point-source discharges of pollutants to surface waters of the United States must comply with the requirements of permits issued under the National Pollutant Discharge Elimination System (NPDES). The NPDES program is administered by EPA under the authority of the federal CWA or by the states through programs delegated by EPA. NPDES permits establish effluent limitations and monitoring requirements for discharges. Effluent limits are based upon the more stringent of levels which can be achieved through the use of available technology, and levels necessary to meet EPA-approved state water quality standards. The CWA requires NPDES permits for E&P waste discharges to surface water. Currently, effluent guidelines prevent most discharge to surface waters except the following categories:

- a. Discharges to certain coastal areas;
- b. Discharges of low-salinity produced waters which are of beneficial use in arid regions west of the 98th meridian; and
- c. Discharges from stripper oil wells in certain areas.

2.4. Federal Definition of Solid Waste

- a. In simplest terms, a solid waste is any material that is discarded or intended to be discarded. According to RCRA, solid wastes may be solid, semi-solid, liquid, or contained gaseous material. Commercial products are not solid wastes unless, and until, they are discarded. Commercial products and their releases may also be regulated under other statutes such as the Federal Insecticide, Fungicide and

Rodenticide Act (FIFRA), the Toxic Substances Control Act (TSCA), Superfund Amendments and Reauthorization Act (SARA), and the Occupational Safety and Health Act (OSHA).

- b. EPA has also determined that produced water injected for enhanced recovery is not a waste for purposes of RCRA Subtitle C or D, since produced water used in enhanced recovery is beneficially recycled and is an integral part of some crude oil and natural gas production processes.

2.5. Hazardous Waste

Under RCRA, a solid waste may be designated as hazardous waste if it is specifically listed as a hazardous waste or if it exhibits one or more of the characteristics of hazardous wastes. (See 40 CFR 261).

2.5.1. Listed Hazardous Waste

- a. EPA has listed numerous types or classes of solid wastes as hazardous waste because they typically exhibit one or more of the characteristics of hazardous waste, or have been shown to exceed certain human toxicity criteria, or contain any one of the chemical compounds or substances that are listed as hazardous constituents. (see 40 CFR 261 APP VIII.)
- b. EPA's regulations contain four lists of hazardous wastes: 1) hazardous waste from non-specific sources; 2) hazardous waste from specific sources; 3) commercial chemical products that become acutely hazardous waste when disposed; and 4) commercial chemical products that become toxic wastes when disposed.

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2.5.2. Characteristically Hazardous Waste

- a. EPA considers any solid waste to be a hazardous waste if it exhibits any one of the characteristics of ignitability, corrosivity, reactivity, or toxicity.
- b. The toxicity characteristic is determined by the toxicity characteristic leaching procedure (TCLP). The list of constituents includes eight heavy metals and thirty-two organic compounds

2.6. EPA's Identification of Exempt Exploration and Production Wastes

The list below identifies many, but not all, exempt wastes. In general, E&P exempt wastes are generated in "primary field operations" and are unique or intrinsic to exploration and production activities (e.g., drilling for, producing, and purifying crude oil and natural gas), and not as a result of maintenance or transportation activities.

All wastes generated in transportation and refining are non-exempt. EPA's regulatory determination for E&P wastes (see 53 FR 25453, July 6, 1988) found that the following wastes are exempt from RCRA hazardous waste management requirements:

"Produced water;

"Drilling fluids;

"Drill cuttings;

"Rig wash;

"Drilling fluids and cuttings from offshore operations disposed of onshore;

"Well completion, treatment, and stimulation fluids;

"Basic sediment and water, and other tank bottoms from storage facilities that hold product and exempt waste;

"Accumulated materials such as hydrocarbons, solids, sand, and emulsion from production separators, fluid treating vessels, and

- production impoundments;
- "Pit sludges and contaminated bottoms from storage or disposal of exempt wastes;
- "Workover wastes;
- "Gas plant sweetening wastes for sulfur removal, including amine, amine filters, amine filter media, backwash, precipitated amine sludge, iron sponge, and hydrogen sulfide scrubber liquid and sludge;
- "Cooling tower blowdown;
- "Spent filters, filter media, and backwash (assuming the filter itself is not hazardous and the residue in it is from an exempt waste stream);
- "Packing fluids;
- "Produced sand;
- "Pipe scale, hydrocarbon solids, hydrates, and other deposits removed from piping and equipment prior to transportation;
- "Hydrocarbon-bearing soil;
- "Pigging wastes from gathering lines;
- "Wastes from subsurface gas storage and retrieval, except for the listed non-exempt wastes;
- "Constituents removed from produced water before it is injected or otherwise disposed of;
- "Liquid hydrocarbons removed from the production stream but not from oil refining;
- "Gases removed from the production stream, such as hydrogen sulfide and carbon dioxide, and volatilized hydrocarbons;
- "Materials ejected from a producing well during the process known as blowdown;
- "Waste crude oil from primary field operations and production; and

"Light organics volatilized from exempt wastes in reserve pits or impoundments or production equipment."

On March 22, 1993, EPA provided "clarification" regarding the scope of the E&P waste exemption. (see 58 FR 15284-15287.) EPA clarified the concept of primary field operations for crude oil and natural gas production. To fall under the scope of the exemption, an E&P waste must be generated in primary field operations and be unique or intrinsic to the production process. In addition, EPA stated that certain waste streams generated by oil and gas service companies may be "uniquely associated" with primary field operations and as such are within the scope of the RCRA Subtitle C exemption. EPA further clarified that an exempt waste remains exempt regardless of the waste's custody transfer, and that the residual waste from the treatment of an exempt waste remains exempt (e.g., residual sediment and water from crude oil reclamation from exempt tank bottoms). EPA's clarification cautioned, however, that exempt crude oil reclamation and service-company wastes may not remain exempt if they are mixed with non-exempt materials or wastes. States should carefully review EPA's clarification along with EPA publication EPA530-K-01-004 (October 2002).

(found at <http://www.epa.gov/epaoswer/other/oil/oil-gas.pdf>). EPA periodically issues interpretive letters regarding the oil and gas exemption. One such letter was issued in November 1993 and is referred to in EPA publication EPA530-K-01-004.

2.7. EPA's Identification of Non-exempt Exploration and Production Wastes

Non-exempt wastes include wastes that are not unique to E&P and wastes generated by transportation (pipeline and trucking) and service activities. While the following wastes are non-exempt, their regulatory status as "hazardous wastes" is dependent upon whether they are listed as hazardous waste or they exhibit a hazardous waste characteristic. Non-exempt wastes should be managed as described under Section 2.8. EPA's 1988 regulatory determination lists the following wastes as non-exempt:

"Unused fracturing fluids or acids;

"Gas plant cooling tower cleaning wastes;

"Painting wastes;

"Oil and gas service company wastes, such as empty drums, drum rinsate, vacuum truck rinsate, sandblast media, painting wastes,

spent solvents, spilled chemicals, and waste acids;

"Vacuum truck and drum rinsate from trucks and drums transporting or containing non-exempt waste;

"Refinery wastes;

"Liquid and solid wastes generated by crude oil and tank bottom reclaimers;

"Used equipment lubrication oils;

"Waste compressor oil, filters, and blowdown;

"Used hydraulic fluids;

"Waste solvents;

"Waste in transportation pipeline-related pits;

"Caustic or acid cleaners;

"Boiler cleaning wastes;

"Boiler refractory bricks;

"Incinerator ash;

"Laboratory wastes;

"Sanitary wastes;

"Pesticide wastes;

"Radioactive tracer wastes; and Drums, insulation, and miscellaneous solids."

EPA did not specifically address, in its 1988 regulatory determination, the status of hydrocarbon-bearing material that is recycled or reclaimed by re-injection into a crude stream. However, under existing EPA regulations, recycled oil, even if it were otherwise hazardous, could be reintroduced into the crude steam, if it is from normal operations and is to be refined along with normal process streams at a petroleum refinery facility. Regulations addressing an exclusion for used oil are at 40

C.F.R. 261.6(a)(4), and regulations addressing an exclusion for recovered oil are at 40 C.F.R. 261.4(a)(12) as revised.

2.8. Requirements for Non-exempt Wastes

- a.** EPA's hazardous waste regulations require that a hazardous waste determination be made for any non-exempt E&P waste. The determination may find the non-exempt waste either to be listed as a hazardous waste or to exhibit a hazardous waste characteristic. If a non-exempt waste is found not to be listed as a hazardous waste or not to exhibit a hazardous waste characteristic, it is a non-exempt non-hazardous waste.
- b.** If a non-exempt waste is not a listed hazardous waste, it should be tested whenever there is reason to believe it may exhibit one or more of the hazardous waste characteristics. Alternatively, a hazardous waste determination may be made based on knowledge of the process by which the waste is produced. Although there is no requirement that a non-exempt waste be tested to determine if it is hazardous, civil and criminal penalties may be imposed if the waste is not managed in a safe manner and according to regulations.
- c.** Depending on the actual hazardous waste quantity generated and accumulated on-site, RCRA hazardous waste management standards for generators may apply. Additionally, treatment, storage, or disposal activities on-site may be subject to more stringent RCRA Subtitle C requirements, such as permitting and corrective action.
- d.** Non-exempt waste should also be segregated whenever possible from exempt waste. If the non-exempt waste was a listed hazardous waste, its mixture with an exempt waste could make the entire commingled waste stream subject to stringent RCRA Subtitle C requirements, including the requirement that the waste be disposed at a hazardous waste facility. When segregation is not practical, the non-exempt waste should be examined closely to assure that it is not a hazardous waste. See Section 2.9 for additional discussion of waste mixtures.
- e.** Some states have adopted hazardous waste regulations and have obtained authority from EPA to administer the federal hazardous waste regulations. Those state programs' regulations may differ from those that EPA has promulgated; however, by law, the states' regulations must be at least as stringent as the federal programs.

2.9. Waste Mixtures

EPA's RCRA regulations provide that the commingling of any listed hazardous waste with a non-hazardous waste generally renders the entire mixture a hazardous waste. The intent of this mixture rule is to prevent avoidance of hazardous waste regulations through dilution. For example, discarding a listed hazardous waste (e.g., a half-empty container of a listed solvent) in a reserve pit could cause the otherwise exempt pit contents to become a hazardous waste and result in the expensive closing of the reserve pit under RCRA hazardous waste regulations. Likewise, the mixing of a characteristic hazardous waste with an exempt waste could render the entire mixture a hazardous waste. Also, in those cases where the mixture is no longer considered a hazardous waste, the process of rendering the hazardous waste non-hazardous could be considered treatment of a hazardous waste and RCRA Subtitle C would apply. Unused commercial products are not exempt wastes when disposed and, if hazardous (or potentially hazardous), should not be disposed with exempt oil-field waste. All reasonable efforts should be made to completely use commercial products, return them to their vendor if they are not fully used, or segregate them from other waste for management and disposal.

SECTION 3

GENERAL CRITERIA

3.1. General

An effective program for the regulation of E&P wastes should include, at a minimum:

- a. Statutory authority which adequately details the powers and duties of the regulatory body;
- b. Statutory authority to promulgate appropriate rules and regulations;
- c. Statutes and implementing regulations which adequately define necessary terminology;
- d. Provisions to adequately fund and staff the program;
- e. Mechanisms for coordination among the public, government agencies, and regulated industry; and
- f. Technical criteria for E&P waste management practices.

3.2. Goals

An effective state program should contain a clear statement of the program's goals and objectives. Such goals should include, at a minimum, protecting human health and the environment from the mismanagement of E&P wastes while recognizing the need for an economically viable oil and gas industry. When establishing regulations and policies for E&P waste management, states should use the waste management hierarchy set forth in Section 5.3 to encourage waste minimization and source reduction.

3.3. State/Regional Variations in Criteria

These criteria are intended to provide guidance to the states in the formulation, development, and evaluation of oil and gas environmental regulatory programs. Fundamental differences exist from state to state, and within regions within a state in terms of climate, hydrology, geology, economics, and method of operation which may impact on the manner in which oil and gas exploration, development, and production

is performed. State oil and gas programs can and should vary from state to state and within portions of a state. The process by which these criteria are incorporated into state programs is a function of, and within the discretion of, the responsible state agency. It is recognized that state programs must vary in order to accommodate differences in climate, hydrology, geology, economics, and method of operation or to accommodate individual differences in state administrative procedures or law. Furthermore, in some instances, in order to accommodate regional, area-wide, or individual differences within a state, it is appropriate for site-specific waivers or variances to be allowed for good cause shown. All such variations should be consistent with the goals of Section 3.2.

SECTION 4

ADMINISTRATIVE CRITERIA

4.1. Basic Requirements

Various federal regulations applicable to the delegation to states of federal environmental programs provide a useful framework for the development of criteria for an effective state program. Programs for E&P waste should, at a minimum, include provisions for permitting, compliance evaluation, and enforcement.

4.1.1. Permitting

A state should have a regulatory mechanism to assure that wastes generated during oil and gas E&P operations are managed in an environmentally responsible manner. A program to achieve that objective may rely on one or more mechanisms, including issuance of individual permits, issuance of permits by rule, establishment of regulatory requirements by rule, issuance of general permits, registration of facilities, and/or notification of certain activities undertaken pursuant to general regulations. State agencies should have authority to refuse to issue or reissue permits or authorizations if the applicant has outstanding, finally determined violations or unpaid penalties, or if a history of past violations demonstrates the applicant's unwillingness or inability to comply with permit requirements. Where the operator responsible for E&P waste management changes, state requirements should address the new operator's financial responsibility and compliance history. An effective state program should provide that a state permit does not relieve the operator of the obligation to comply with federal, local, or other state permits or regulatory requirements.

Individual permits for specific facilities or operations should be issued for fixed terms. In the case of commercial or centralized facilities, permits, generally, should be reviewed and revised, if necessary, no less frequently than every five years. Where similar requirements are mandated by two or more regulatory programs, those requirements should be combined where feasible. The process for obtaining permits and other authorizations should also involve prompt consideration and response to applications while preserving the integrity of the permit review process, including appropriate public participation. For the purposes of these guidelines, the terms "license" or "licensing" as used in Section 7 of these guidelines, criteria for the management of oil-field NORM, will be synonymous with the terms "permit" or "permitting" as

they are used throughout these guidelines.

4.1.2. Compliance Evaluation

4.1.2.1.

State programs should contain the following compliance evaluation capabilities:

- a.** Procedures for the receipt, evaluation, retention, and investigation for possible enforcement action of all notices and reports required of permittees and other regulated persons. Investigation for possible enforcement action should include determination of failure to submit these notices and reports. Effective data management systems as prescribed in Section 4.2.7. can be used to track compliance.
- b.** Inspection and surveillance procedures that are independent of information supplied by regulated persons and which allow the state to determine compliance with program requirements, including:
 - i.** The capability to conduct comprehensive investigations of facilities and activities subject to regulation in order to identify a failure to comply with program requirements by responsible persons;
 - ii.** The capability to conduct regular inspections of regulated facilities and activities at a frequency that is commensurate with the risk to the environment that is presented by each facility or activity; and
 - iii.** The authority to investigate information obtained regarding violations of applicable program and permit requirements.
- c.** Procedures to receive and evaluate information submitted by the public about alleged violations and to encourage the public to report perceived violations. Such procedures should not only involve communications with the public to apprise it of the process to be followed in filing reports or complaints, but should also communicate how the state agency will assure an appropriate and timely response.
- d.** Authority to conduct unannounced inspections of any regulated site or premises where E&P activities are being conducted, including the authority to inspect, sample, monitor, or otherwise investigate compliance with permit conditions and other program requirements.
- e.** Authority to enter locations where records are kept during reasonable

hours for purposes of copying and inspecting such records.

- f. Investigatory procedures that will produce a paper trail to support evidence which may be admitted in any enforcement proceeding brought against an alleged violator, including clear inspection and inspection reporting procedures.

4.1.3. Enforcement

4.1.3.1.

With respect to violations of the state program, the state agency should have effective enforcement tools, which may include the following actions¹:

- a. Issue a notice of violation with a compliance schedule;
- b. Restrain, immediately and effectively, any person by order or by suit in state court from engaging in any impending or continuing unauthorized activity which is causing or may cause damage to public health or the environment;
- c. Establish the identity of emergency conditions which pose an imminent and substantial human health or environmental hazard that would warrant entry and immediate corrective action by the state agency after reasonable efforts to notify the operator have failed;
- d. Sue or cause suit to be brought in courts of competent jurisdiction to enjoin any impending or continuing violation of any program requirement, including any permit condition, without the necessity of a prior revocation of the permit;
- e. Require, by administrative order or suit in state court, that appropriate action be undertaken to correct any harm to public health and the environment that may have resulted from a violation of any program requirement, including, but not limited to, establishment of compliance schedules;
- f. Revoke, modify, or suspend any permit upon a determination by the state agency that the permittee has violated the terms and conditions

¹ *In some states, enforcement remedies include authorities to cause cessation of production or transportation of product, and/or seizure of illegal product.*

of the permit, failed to pay an assessed penalty, or used false or misleading information or fraud to obtain the permit; or

g. Assess administrative penalties or seek, in court, civil penalties or criminal sanctions including fines and/or imprisonment.

h. Forfeiture of financial assurance instruments.

4.1.3.2.

States should develop guidance for calculations of penalties that include factors such as the economic benefit resulting from the violation, willfulness, harm to the environment and the public, harm to wildlife, fish or aquatic life or their habitat, expenses incurred by the state in removing, correcting or terminating the effects of the unauthorized activity, conservation of the resource, timeliness of corrective action, notification of appropriate authority, and history of violations. Benefits of guidance for calculation of penalties include consistency in the assessment of penalties and development of readily defensible assessments. Penalties should be such that an operator does not benefit financially from unlawful conduct, and should provide compliance incentive to other operators. States should evaluate their enforcement options and policies to assure that the full range of actions available are effectively used.

4.1.3.3.

The right to appeal or seek administrative and/or judicial review of agency action should be available to any person having an interest which is or may be adversely affected, or who is aggrieved by any such action.

4.2. Additional Program Requirements

Beyond basic requirements, an effective state program should also include a variety of other administrative requirements as discussed below.

4.2.1. Contingency Planning and Spill Risk Management

4.2.1.1. State Program Elements

a. Scope. The state should develop and adopt a program for preventing and responding to spills and unauthorized releases to land or water

from E&P facilities. The state program need not duplicate SPCC or other applicable federal regulations for contingency planning and spill risk management.

- b. **Threshold Levels.** The program should define the volume of a spill or release of a petroleum product or waste and the level of risk to various receiving environments that trigger implementation of the response requirements.
- ~~c.~~ **Funding.** The program should also contain funding provisions which enable the state agency to undertake immediate response actions for significant spills or releases which constitute a threat to human health or the environment in the event that a responsible operator cannot be located or is unwilling or unable to respond to the spill or release in a timely manner.
- d. **Reporting Capabilities.** The state should provide mechanisms for operators or the public to report spills and unauthorized releases. These mechanisms should include telephone access 24 hours a day, 7 days a week. A single point of contact 1-800 telephone number should be considered. Telephone answering capabilities should include provisions for the prompt notification of appropriate state agency personnel.
- e. **Interagency Coordination.** The state should provide for coordination of actions between appropriate agencies that have jurisdiction for the management of risks from spills and unauthorized releases from E&P facilities. This includes clear designation of onsite spill responsibilities.
- f. **Follow-up Actions.** The state program should provide for enforcement, as described in Section 4.1.3. of these Guidelines, for the failure of an operator to report or respond to spills and unauthorized releases as required. The state program also should consider provisions for the assessment of damages caused by an incident. A state program should contain provisions allowing the state to pursue a responsible operator for reimbursement of state monies expended in responding to such a spill or release.
- g. **Database.** The state data management program, as described in Section 4.2.7. of these Guidelines, should include information on spills and unauthorized releases. This data should be analyzed periodically as part of a program effectiveness evaluation as described in Section 4.2.3, Program Planning and Evaluation, of

these Guidelines.

4.2.1.2. Program Requirements

The state should require an operator to take measures to prevent, and prepare to respond to, spills or unauthorized releases of petroleum products or waste that may occur at an E&P facility. These requirements can be spelled out in regulations or guidance, or they may be included in operator-specific or site-specific plans.

4.2.1.2.1. General. State program requirements should address three key areas:

a. Sources and receiving environments.

- i. Sources to be considered include E&P facilities, equipment at those facilities, and materials found at E&P sites that may pose a significant threat to human health and/or the environment.
- ii. Receiving environments to be considered include water (surface and groundwater) and land (environmentally sensitive areas, special soil or geological conditions, urban areas, cultural and special resource areas).

b. Communications and logistics.

- i. Areas of communications to be addressed should include the operator's incident command structure, including emergency contact information for key personnel, and procedures for identification of and communication with parties impacted or threatened by spills or unauthorized releases.
- ii. Areas of logistics to be addressed should include any equipment, manpower, contracted services, and other logistical support necessary for response to spills and unauthorized releases. Other areas include opportunities for coordination of joint response actions, manpower, or equipment with nearby well sites or other facilities of the operator or other operators.

c. Training issues to be addressed include training to prepare response personnel to respond efficiently, effectively and in a manner ensuring public and responder safety.

4.2.1.2.2. Prevention Measures

Where spills and unauthorized releases pose a significant risk to human health and/or the environment, the State should require prevention measures, which may include:

- a. Secondary containment, such as dikes, berms and firewalls, or equivalent measures. In high risk areas, tertiary containment and/or monitoring systems may be appropriate.
- b. Inspection, testing, and maintenance schedules and procedures for facilities and equipment.
- c. Site security measures as necessary.
- d. Periodic review of spill histories to identify opportunities to reduce future spills and unauthorized releases.

4.2.1.2.3. Response Measures

- a. A State program should include reporting and notification procedures to be used by the operator in the event of a spill or unauthorized release. These should include:
 - i. Who to notify. The program should identify which agencies and parties must be notified and provide contact information for the agencies.
 - ii. How to notify. The program should specify which type of reporting (verbal, written) is required for various incidents.
 - iii. When to notify. The program should determine appropriate reporting time requirements and reporting thresholds.
 - iv. What to report. Information to be reported should include the names of the operator and the operator's representative reporting the incident; a description of the incident, including the date and time of the incident and its discovery; the type and volume of material released; the location of the incident; the apparent extent of the release; damage or threat to groundwater, surface water and land; and weather conditions.
- b. States should provide guidance for containment, abatement, and remediation, including:

- i. acceptable methods of containment of spills and unauthorized releases and acceptable disposal methods, such as on-site remediation, approved disposal facilities, and waste haulers, for materials of concern;
 - ii. cleanup standards;
 - iii. required sampling and analyses; and iv. where appropriate, approved non-mechanical response actions, such as the use of dispersants, in-situ bioremediation or in-situ burning, including identification of the agencies that must provide approval of these operations.
- c. The state should specify any requirements for final reporting, site monitoring, and necessary agency approvals. Any final report required should identify the cause of the incident and actions taken to prevent or minimize the likelihood of a recurrence.

4.2.2. Public Participation

4.2.2.1. Notice and Records

State program legislation or regulations should require that the affected public be provided with adequate notice of the agency's intention to issue a permit or license that addresses E&P waste management. The public should be provided with an appropriate opportunity to comment on a permit or license prior to issuance. Wherever possible, this notice should be coordinated with the notice requirements of other concurrently applicable state or federal programs. For commercial or centralized disposal facilities, the operator should also be required to provide written notice to adjacent landowners of record for such area and in such manner as may be prescribed by the state agency.

Agency records related to this program should generally be available for review by the public. Such records are to include waste disposal and pit locations and any required analytical data. Where information submitted by an operator is of a "confidential business" nature, an agency should have procedures for segregating that information and protecting it from disclosure. In all cases, spill and violation records should be available to the public. Agencies should establish a minimum record keeping time period of three years which should be automatically extended while any unresolved enforcement action regarding the regulated activity is pending.

4.2.2.2. Program Information

States should provide for the dissemination of program information to the regulated industry and the public. Such educational materials should include information or guidance on contingency planning, spill response, permitting, operating, monitoring and other requirements. Such efforts should be part of an ongoing process through which information is exchanged in an open forum. Because E&P waste management requirements are undergoing numerous changes, states have the obligation to inform the regulated industry and the public of changes. Industry associations and other organizations may provide a convenient and effective mechanism for dissemination of information. States should actively make use of seminars, newsletters, special mailings, association committees, incentive programs and other mechanisms.

4.2.2.3. Advisory Groups

States should use advisory groups of industry, government, and public representatives, or other similar mechanisms, to obtain input and feedback on the effectiveness of state programs for the management of E&P wastes. Provision should be made for education or training as is appropriate to give such advisory groups a sound basis for providing input and feedback.

4.2.3. Program Planning and Evaluation

4.2.3.1. Program Planning

States should have a sound regulatory development process which includes both short-term and long-term strategic planning for defining goals and objectives, setting priorities, and evaluating the clarity, efficiency, and effectiveness of the E&P waste management program. In formulating waste management regulations, states should use the best available scientific and technical information and should consider the environmental, economic and energy impacts of the regulations.

4.2.3.2. Program Evaluation

a. General

Beyond the general, technical and administrative criteria set forth elsewhere in this guidance document, a program for the regulation of E&P waste should evaluate how well the program protects human health and the environment while recognizing the need for an economically viable oil and gas industry.

Program evaluation measures may be of a wide variety and include positive indicators (what’s working) as well as negative indicators (what’s not working). Some administrative aspects of program performance can be evaluated by examining how well the program enables the industry, the public, and the regulators themselves to function. Environmental aspects can be evaluated by assessing some combination of preventive measures, the qualities and characteristics of oil field wastes the severity of impact from a spill or unauthorized release, and the timeliness of remediation. While it is important for the program to have adequate rules, performance evaluation indicates to what extent the implementation of a rule or practice of the program brings about environmental protection.

Although a formal evaluation of program performance might occur at periodic intervals, the monitoring of activities and the modifications to the program form an ongoing, cyclic process as outlined in Figure 4.1. The process has no specific beginning or ending point. Rather, the steps in the process form a continuous progression that should be examined during performance review.

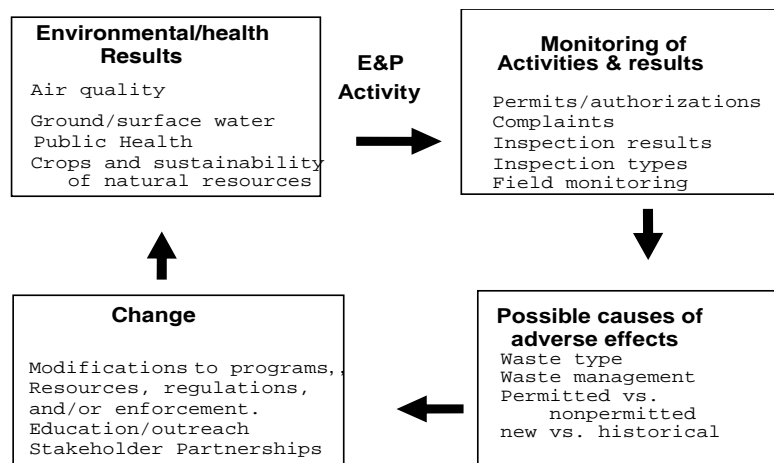


Figure 4.1. Performance review cycle.

A state should select parameters that are appropriate for use in measuring the effectiveness of its E&P waste program. Documentation

of the selected parameters and the ability to acquire, assess, and present the relevant data are critically important to evaluation of performance. This requires establishing a definition of the parameters being evaluated and specifying the technical measurements to be made or the technical data to be examined. In addition, it requires installation and use of a data management system that facilitates review and evaluation. Program performance should be evaluated periodically, using measures that can be applied consistently from one evaluation period to another, although the measures may evolve and improve in time. If a database of releases, regulatory activities, remediation sites, or other information is used for performance evaluation, it should, if possible, extend backward in time so as to enable a measure of progress on historical problems.

b. Qualities of Performance Measures

In evaluating its performance, a program should have data management capabilities to enable assessment of program effectiveness and timeliness. Evaluation measures should:

- be quantitative, whenever possible;
- allow consistent evaluation across time;
- be available to program personnel, the industry, and the public;
- document significant trends;
- summarize an evaluation of the nature and extent of contamination [Section 5.2], abandoned wastes, and abandoned facilities [Section 6] as they occur across the state;
- include identification and priority of outstanding environmental threats, so as to aid the program in targeting its efforts;
- enable evaluation of whether the program's responses to violations encourage compliance.

Evaluation of performance may include, but not be limited to:

- Contamination: the state-wide nature and extent of environmental contamination by E&P wastes;
- Trends: whether the extent of contamination by E&P wastes is increasing or decreasing, and the reasons why;
- Prevention: the effectiveness of the program's efforts in preventing releases of E&P wastes to the environment;
- Timeliness: the timeliness of agency actions in controlling the impacts of E&P wastes released to the environment;
- Abatement: the effectiveness of agency actions in abating pollution by E&P wastes, or in causing pollution to be abated; and
- Enforcement: the effectiveness of the agency's administrative

controls in the prevention or abatement of pollution by E&P wastes [Section 4.1].

c. Examples of program evaluation

i. Assessment of impacts

A state could identify documented cases that demonstrate reasonably clear links of cause and effect between operational practices and resulting environmental impacts. Such impacts might be human health effects, ecological effects, effects on_wildlife or livestock, or effects on natural resources.

From examination of documented cases, a state could determine whether those cases were the result of violations of existing program requirements, insufficient programmatic enforcement of the requirements, other causes, or whether the cases suggest that the requirements should be revised.

A case could be documented if impacts are found to exist as part of the findings of a scientific study. Such studies could be formal investigations supporting litigation or a state enforcement action, or they could be the results of technical tests (such as monitoring of wells) if such tests (a) were conducted with state-approved quality control procedures, and (b) revealed contamination levels in excess of an applicable state or federal standard or guideline (such as a drinking water standard or water quality criteria).

Possible impact indicators might be:

- The area or other measure of contaminated or affected ground or surface water, tracked periodically over time.
- A histogram of the number of releases versus time, amount of produced resource and number of wells in the state. Releases might be grouped by material released, such as crude oil, produced water, etc.
- A histogram of the number of releases of a given material versus the approved time to completion of remediation.
- The time elapsed between an agency's receipt of a remediation proposal or related correspondence, and the agency's response to that proposal or correspondence.

ii. Analysis of activities and results

Activity and results analysis comprises administrative measures of program goals, plans, and operations. These measures focus on

prevention of pollution, efficiency of operations, priorities, and the allocation of resources within the program.

The following are examples of activities:

- The development of a strategic plan with goals, milestones, and establishment of priorities [Sections 3.2, 4.2.3]. The plan should be based on anticipated threats and/or known impacts, as well as budget and administrative factors that may be beyond the control of the agency.
- The development of a program promoting use of the waste management hierarchy [Section 5.3].
- A review of the number of stream miles listed as impaired by oil and gas activities in the state biennial Integrated Water Quality Monitoring and Assessment Report required under Sections 305(b) and 303(d) of the federal Clean Water Act.
- An evaluation of the number of wells abandoned without being properly plugged compared to levels of financial assurance or other program measures to address orphan wells.
- Evaluation of the results of surveys to determine the satisfaction of permit recipients and other customers with program implementation.
- The development of a program, including time and activity tracking, to conduct efficiency studies of average time to issue permits, conduct inspections and perform other required activities.
- A documented process for obtaining input from within the agency, from the public, and/or from an advisory group for identification of program strengths and deficiencies [Section 4.2.2.3].
- Evaluation of the results of a training, educational, or outreach program [Section 4.2.2].
- Evaluation of the effectiveness of the agency's enforcement program. [Sections 4.1.2., 4.1.3, 4.2.1.2].

The following are examples of results:

- The number of inspections by the agency.
- The number, type and causes of spills, accidents and safety incidents reported to the agency.
- The number of operations witnessed by the agency.
- The number, type, frequency and cause of violations detected by inspectors [Section 4.1.2].
- The number, type, frequency and cause of complaints by the public, and the time required to resolve those complaints [Section 4.2.2.1].

- The number of violations, the time to resolve those violations, and the number unresolved [Section 4.1.2].
- The number of actions going to hearing, enforcement, and/or fines [Section 4.1.3].

d. Baselines and Follow-up

A state agency should regularly evaluate its effectiveness in attaining the goals set forth in Section 3.2 in a way that will create a baseline against which to compare the program's performance in the future.

A state agency is encouraged to conduct periodic self-assessments in addition to the assessments conducted in the State Review Process. These self-assessments should document successes and should identify areas for improvement. This will allow continual improvement of a state's program while recording its successes

The utilization of performance evaluations and a continual improvement process will demonstrate the state's efforts to adapt to changes in technology, concerns of the public and regulated community, and to provide both for the documentation of successes and identification of areas requiring improvement.

4.2.4. Financial Assurance

All states should have an adequate financial assurance program to provide resources to the state to close or remediate a site should an operator fail to meet its obligations under the law. The goal of any financial assurance program should be to avoid passing on the responsibility for closure and remediation costs to the citizens of the state. An adequate financial assurance program should be supported by the following elements: frequent site inspections; strict permit enforcement; and appropriate regulations governing and monitoring "inactive status" of covered facilities.

States should identify those activities such as closure and remediation and other relevant activities for which criteria have been set forth in Section 5 that need to be covered by financial assurance. Some states require financial assurance for inactive wells, some for drilling and/or plugging, some for waste disposal facilities, and some for the life of the well.

States should determine the types of financial assurances that will provide reliable monetary resources to the state and will facilitate an

operator's compliance with permit requirements. Types of financial assurance include surety bonds; self-bonding; letters of credit; certificates of deposit; cash, federal, state, or municipal bonds; and other forms of collateral. Some states require performance bonds and some states require penal bonds. Some states accept a nonrefundable fee to be paid into the well plugging fund in lieu of a bond. Some states allow phased payments of collateral into a fund so that small operators can develop a collateral bond over a specified period of time. States should develop financial assurance options which facilitate an operator's compliance with bonding requirements. In addition to single well bonds, many states allow blanket bonds. This allows operators to assure that an established minimum level of financial assurance is provided without the commitment of an unnecessary amount of operating funds.

States should periodically review the amount of assurance required to determine if the amount is adequate to provide incentive for proper plugging of a well and reclamation of a site, and to assure proper management of E&P wastes.

In the case of commercial and centralized facilities as defined in Section 5.10, including those that manage oil-field NORM, state financial assurance requirements should be sufficient to cover the costs of appropriate facility decontamination, reclamation, and closure, and should extend through any post-closure care, monitoring, or control period. (see Section 5.10.2.2.e.)

States should develop appropriate procedures to access an operator's financial assurance when the operator does not meet the obligations covered by the financial assurance. These procedures should include provisions for notice, hearings, and forfeiture.

Some states have special funds, such as well-plugging funds, that are available for state use to correct problems where an operator does not comply with state requirements. Although the availability of such funds may be a consideration in some states when determining bond coverage amounts, special funds should be used to supplement rather than completely take the place of other forms of financial assurance provided by the operator. The use of special funds should be limited to instances where the responsible operator cannot be determined or is unavailable. These special funds can be generated by taxes, fines, forfeitures, or fees.

4.2.5. Waste Hauler Certification

The appropriate state agency should have authority to require the training of drivers of trucks which are involved in the commercial transportation of E&P waste to a commercial or centralized disposal facility. Such training should include, among other things, emphasis on proper record keeping, the need to deliver the waste to the designated facility and emergency response and notification procedures. The appropriate state agency should also have authority to require the registration of all vehicles used to commercially transport the waste and of all commercial waste haulers.

4.2.6. Location of Closed Disposal Sites

A state program should contain authority with respect to disposal site closure, including authority to identify the location of the disposal site and for such information to be permanently maintained by the state agency for public review. Whether the location of a waste disposal site is disclosed in the public land records is a matter which is within the discretion of the state.

4.2.7. Data Management

4.2.7.1 General

Effective data management systems should be maintained due to the amount of information that states compile. Such systems should include permitting, operating, spill, remediation, and monitoring information and should include those data elements that an individual state finds are necessary to make cost-effective, risk-based decisions. Data should be maintained on as detailed a level as is necessary for the agencies to conduct their regulatory reviews. States and the federal government should undertake efforts to facilitate the sharing of data among responsible agencies, the public, and other users. The IOGCC and federal government should continue to assist the states in developing and maintaining effective data management systems.

States are encouraged to track and maintain the minimum data set described in the IOGCC publication Guidelines for States: Exploration and Production Data Management (November 1996). States are further encouraged to capture and maintain the expanded dataset described in that publication to the extent possible. States should develop policies for data access, data dissemination, and the allocation of cost of services to governmental and non-governmental users.

4.2.7.2 Electronic Data Management

Electronic filing, permitting, imaging, geographic information systems and internet data transfer and access are emerging technologies which can contribute to program efficiency and data accessibility, although they are not required for effective waste management. However, because of the efficiencies of electronic data management and enhanced accessibility of electronic data to regulators, the industry and the public, agencies are encouraged to develop systems for the electronic submittal, storage and retrieval of agency data. States are encouraged to evaluate implementing electronic data management systems to improve program efficiency and data access to the extent they are appropriate to the State's regulatory program.

4.2.7.3 Program Elements

Agencies should provide for the capture of data and images as appropriate, and for both protecting the quality of data collected and the long-term protection and backup of captured information through measures such as off-site duplicate storage, archiving, and/or data retention and destruction policies. Agencies should include public and industry access in their data management systems.

Most program data are available to the public under various sunshine rules. Some records may be retained as confidential files for a defined period of time. Certain confidential types of data may also be discoverable. States should develop policies that define data sets to be made available to the public and/or industry.

4.3. Personnel and Funding

4.3.1. Personnel

For a state program to function effectively, sufficient, properly trained personnel to accomplish the goals and objectives of the program are necessary.

In determining its personnel needs, a state agency should consider not only the number of activities that it must regulate and inspect, but also the accessibility of those activities to agency personnel. Accessibility will be heavily influenced by the size of the area to be regulated, the local terrain, and road conditions. In addition, a state agency should evaluate how its personnel needs will be affected by activities occurring in environmentally sensitive areas (e.g., in close proximity to surface water and groundwater).

Generally, personnel needs should be evaluated in each of the categories of administration, legal, technical, and field inspectors. In each case, a state agency should define the areas of responsibility for the position, as well as any prerequisite experience and background. In addition, the state agency should provide for the continuing training of personnel to keep them abreast of changes in regulations, policy and technical issues, and to increase professionalism. This training can be accomplished through such means as seminars and university short courses. The following discussion addresses these issues in each of the major personnel categories:

4.3.1.1. Administration

The elements of the administration of a state program should include traditional administrative functions such as program planning and evaluation, budgeting, and personnel. In addition, administration should be responsible for such programmatic functions as permitting, licensing, financial assurance, and ownership transfer. Public involvement and data collection management are also key elements of program administration. The conduct public hearings, the coordination of enforcement activities, and the referral of cases to legal personnel for follow-up action should also be administrative functions.

4.3.1.2. Legal

Legal support for an E&P waste management program can be provided by in-house state agency lawyers through the support of the attorney general's office or through independent counsel. In any case, sufficient legal support should be provided to a state agency to assure that the regulatory program has an effective capability to pursue appropriate enforcement actions in a timely manner against violators of program requirements. A critical element of this capability is that the program's legal element be capable of directing the preparation of enforcement cases and providing guidance and direction to field inspectors and others involved in case preparation. The legal element of a program should also be involved in both the procedural and substantive aspects of rulemaking.

4.3.1.3. Technical

All program elements require adequate technical support. In supporting administrative functions, technical personnel should provide geologic and engineering evaluation, and technical specifications on such matters as cementing and casing. Technical support to the legal and

field personnel is necessary for the development and implementation of rules and in the preparation of enforcement cases. In support of field inspectors, technical personnel should be capable of mapping hydrologically sensitive areas and areas containing treatable water, and provide support in determining pit construction requirements and guidance in waste handling. Key technical personnel should have a bachelor of science degree in geology, engineering, hydrology, earth science, environmental science, or a related field, or possess equivalent experience. Technical personnel should be subject to continuing education in such areas as ongoing development of rules, policies, and technological changes.

4.3.1.4. Field Personnel

Field personnel should be responsible for conducting routine inspections of regulated facilities and activities to assure compliance with program requirements. In addition, field personnel should be among the state agency's on-site representatives to witness critical regulated activities and to observe or supervise clean-up or remedial actions. Field personnel also should be involved in the assembly of evidence for enforcement actions and in the state agency's community relations. Field personnel generally should be high school graduates or have equivalent experience, and should otherwise be knowledgeable about oil and gas field-related work and waste management practices. The ongoing training of field personnel should emphasize the range of chemical and radiological constituents in E&P wastes and at E&P sites, sampling and investigative procedures associated with enforcement proceedings, and a thorough understanding of current rules and policies of the program, as well as sound environmental practices. Field personnel should be provided with training in NORM identification and management, where appropriate. In addition, field personnel should be skilled in the handling of hazardous materials and in all aspects of personnel safety.

4.3.1.5. Training Requirements

State programs should provide for adequate and effective training of state agency personnel regarding the regulations, policies, and criteria applicable to E&P waste management. These programs should include training for agency personnel on such issues as site maintenance, contingency planning and spill response, permitting requirements and standards, compliance requirements and criteria, data management, enforcement procedures, investigative procedures, court preparation, report writing, sampling and analysis, and such other issues relating to

proper E&P waste management as may be necessary. Training programs should be incorporated as an on-going activity to encourage consistent enforcement of regulation throughout the state.

4.3.2. Funding

An effective E&P waste management program should be funded at a level sufficient to allow it to accomplish its environmental protection goals and objectives. While many state agencies are funded through a general appropriation from that state's legislature, each state agency should evaluate other sources of funding such as user fees, special levies on production, the dedication of fees and penalties to special accounts, and grants from various sources.

4.4. Coordination Among Agencies

Many state programs regulating the management of E&P wastes have their roots in oil and gas conservation programs that were established during the early part of the last century. In most cases, these programs have evolved to accommodate other state and federal objectives such as protection of human health and the environment.

In most states, multiple agencies are involved in the management of E&P wastes. Different agencies are often responsible for the regulation of oil and gas wells, pits and impoundments, disposal wells, surface water discharges, spill prevention and response, and disposal of drill cuttings and muds. Each agency has its own administrative requirements relating to permitting, operational requirements, and financial assurance, and develops its own budget priorities. Each has its own inspection and enforcement authorities. Unless a high level of formal interagency coordination exists, such unilateral program development and implementation can lead to duplication of personnel effort, duplication of regulation with sometimes conflicting standards for the industry, and duplication of funding. Duplication of programs often diminishes the effectiveness of spill response, permitting, inspection, enforcement, training, and other regulatory activities. Where multiple state agencies have jurisdiction over the management of E&P wastes, budget development should be coordinated and the agencies should develop formal coordination procedures, such as the development of interagency Memoranda of Agreement, interagency task forces with periodic meetings, and/or interagency legislative and regulatory review panels to ensure jurisdictional clarity and regulatory consistency.

Additionally, states should review existing agreements to assure that they are current and effective. Finally, interagency mechanisms should be developed to facilitate the sharing of information among and between involved agencies so that each agency can carry out its program responsibilities.

SECTION 5

TECHNICAL CRITERIA

5.1. General

These technical criteria for E&P waste management practices address waste characterization, waste management hierarchy, pits, land applications, tanks and centralized and commercial facilities. In most cases, these criteria are general in scope. The states should establish and implement specific performance standards and design specifications based on site-specific or regional differences in geology, hydrology, climate, and waste characteristics. State E&P waste management programs should include the following general provisions as requirements:

- a. Facilities and sites used for the storage or disposal of wastes derived from the exploration and production of oil and natural gas should be operated and managed at all times to prevent contamination of groundwater and surface water, soil and air, protect public health, safety and the environment, and prevent property damage.
- b. Facilities and sites operated specifically for the storage or disposal of exempt E&P wastes should not receive, collect, store, or dispose of any wastes that are listed or defined as hazardous wastes and regulated under Subtitle C of RCRA, except in accordance with state and federal hazardous waste laws and regulations.
- c. Disposal of E&P wastes into landfills may be considered. If such disposal is allowed, it should only be allowed where the landfill is designed to contain such wastes, and the E&P wastes contain no free liquids and are not mixed with non-exempt wastes prior to disposal.
- d. Technical criteria for siting, construction, and operation of E&P waste disposal facilities should be flexible enough to address site-specific or regional conditions based on findings by the regulatory agency.
- e. Siting Criteria
 - i. States should incorporate siting requirements in statewide rules for pits, landspreading, landfilling and burial, and waste reclamation facilities. Area-wide rules or site-specific permits may contain additional siting conditions.

- ii. No E&P waste management facility should be located in a flowing or intermittent stream.
- iii. Where necessary to protect human health, new E&P waste management facilities should not be located in close proximity to existing residences, schools, hospitals or commercial buildings. The need for minimum distance criteria from residences or other buildings to the boundary of E&P waste management facilities should be considered.
- iv. Generally, applicable siting requirements should address such factors as depth to and quality of groundwater, wetlands, floodplains, topography, proximity to existing drinking water supplies and wells, geology, geologic hazards, and other environmentally sensitive areas.
- v. Siting of E&P waste management facilities should be consistent with applicable land-use requirements.

5.2. Waste Characterization

5.2.1 Purposes

Waste characterization should support at least the following functions of a state's E&P waste management program:

- a. ensuring E&P waste management practices are suited to the particular wastes involved and in compliance with applicable program requirements; and
- b. ensuring commercial E&P waste facilities are managing only wastes they are authorized to handle.

5.2.2. Sampling and Analysis

- a. State waste characterization requirements should include appropriate testing of E&P wastes prior to disposal for such characteristics as organic content, pH, salinity, and sulfur compounds, including hydrogen sulfide content. Testing must be appropriate for the type of waste, method of disposal, and the potential for adverse health and environmental effects. In addition, while nothing in these criteria mandates testing for every hazardous constituent in E&P wastes, it is recognized that waste management practices and regulatory

requirements would be improved by obtaining a more complete knowledge, through sampling and analysis, of the range of hazardous and toxic constituents in E&P wastes. Accordingly, waste characterization requirements should provide data necessary to meet the purposes of waste characterization described in section 5.2.1 and to administer and enforce state program requirements effectively.

- b. State requirements for the assessment of E&P wastes for Naturally Occurring Radioactive Material (NORM) should meet the criteria of this section and of sections 7.3.3. and 7.3.9. Such requirements should address all types of radiation expected in E&P wastes.
- c. These guidelines do not address all the details of a waste characterization program, such as testing methods, frequencies, or parameters. The details are expected to vary depending upon the waste, the proposed management practice, and other state program requirements.

5.2.3. Quality Control

- a. State programs should contain provisions that any required waste sampling follow appropriate sampling procedures, and any required laboratory analysis be performed by qualified laboratories in order to produce valid and reliable results. A state may rely on field testing to satisfy waste characterization requirements where it can be determined that such testing will produce valid and reliable results.
- b. Testing methods should produce data that are valid for the purpose intended. For example, EPA's Toxicity Characteristic Leaching Procedure (TCLP) may not accurately predict the leachability of oily E&P wastes.

5.3. Waste Management Hierarchy

As in any aspect of waste management, there are some general, sound practices that should be employed. These practices, which emphasize waste minimization, not only serve to protect human health and the environment, but also tend to protect waste generators from long-term liabilities associated with waste disposal. Additionally, waste minimization may reduce regulatory compliance concerns for E&P operators and result in cost savings. Generally, the choice of an E&P waste management option should be based upon the following hierarchy of preference:

- a. **Source Reduction:** Reduce the quantity and/or toxicity of the waste generated;
- b. **Recycling:** Reuse or reclaim as much of the waste generated as possible, and whenever possible, combine hydrocarbons with crude oil, condensate, or natural gas liquids;
- c. **Treatment:** Employ techniques to reduce the volume or the toxicity of waste that has been unavoidably generated.
- d. **Proper Disposal:** Dispose of remaining wastes in ways that minimize adverse impacts to the environment and that protect human health.

5.3.1. Source Reduction Opportunities

There are significant source reduction opportunities in E&P waste management. State programs have a variety of available resources which provide proven source reduction techniques. Categories of source reduction opportunities and examples include:

- a. **Equipment Modifications:** Many technically and economically feasible equipment modifications are available. For example, retrofitting glycol dehydration units with volatile organic vapor recovery units can result in the recovery, in certain circumstances, of economically viable quantities of volatile hydrocarbons that would otherwise be released to the atmosphere. In addition, compliance concerns regarding air emission regulations may be reduced considerably.
- b. **Procedure Changes:** Many times a simple change in the procedure used in an operation can result in significant source reduction. A simple example with significant results is the change one operator made in produced water filter replacements in an EOR project. The original procedure of bi-monthly filter replacements was changed to a procedure based on filter differential pressure. The result was a 98% reduction in the quantity of generated waste filters. At production sites where NORM-scale formation is expected, implementing a procedure of scale inhibitor injection may reduce its occurrence.
- c. **Product Substitution:** The careful selection of chemical products used in exploration and production can reduce the toxicity of E&P wastes. Potential product substitution candidates include biocides, coagulants, dispersants, emulsion breakers, scale and corrosion

inhibitors, gas sweetening and dehydration agents, catalysts, and pipe dope. In particular, many substitute drilling fluids have been developed to replace oil-based drilling fluids.

- d. **Reduction in the Use of Fresh Water:** A significant example of the reduction of fresh water use is the use of produced water for EOR whenever possible. Another simple example is the use of high-pressure, low-volume nozzles on rig wash hoses.
- e. **Good Housekeeping and Preventive Maintenance:** In addition to product substitution, source reduction can be achieved by minimizing the generation of clean-up wastes from production facilities and waste management facilities. An evaluation of potential spills and mitigation measures may identify effective spill and release prevention techniques. These techniques include good housekeeping practices, routine inspections of equipment, equipment innovations, and containment systems. Radiation surveys of equipment and sites can be helpful in preventing or minimizing the spread of above-background levels of oil-field NORM that may be encountered during routine equipment maintenance and servicing and site cleanup.
- f. **Planning:** The first opportunity to accomplish source reduction is in the planning stage of an operation. For example, careful planning of a well stimulation can result in the reduction of left over chemical that may be disposed. Also, careful planning of a drilling site's construction to control stormwater runoff may reduce the quantity of contaminated stormwater that may be generated as waste.
- g. **Training:** Training is possibly the most important source reduction opportunity. Personnel in the oil field conduct the activities that generate waste. Training in waste identification, classification, and source reduction techniques provides the field personnel with the tools necessary to effectively reduce waste generation.
- h. **Selection of Contractors:** Service companies perform a wide variety of functions in the oil field on behalf of E&P operators. An important source reduction opportunity for operators is the selection of service companies that implement source reduction opportunities as a business practice.

5.3.2. Recycling Opportunities

Many opportunities now exist to recycle E&P wastes. State programs may coordinate with recycling programs developed by other agencies responsible for waste management. For example, many states' agencies provide listings of companies that recycle wastes common to E&P and, in some instances, operate waste exchange programs.

Wastes generated at E&P facilities that may be recycled include drilling fluids, used lubricating oil, used lubricating oil filters, antifreeze, wooden pallets, spent solvents, unused chemicals, and scrap metal. Also, recycling opportunities include the use of produced water for enhanced recovery, and the recovery of hydrocarbons in crude oil tank bottoms, skim oils, gas pipeline drips, slop oil emulsions solids and sludges, and other oily sludges.

Recycling also includes reuse of materials that would otherwise be managed as waste. For example, a natural gas company found that partially spent caustic sweetening solution was suitable for use as reagent in sulfur dioxide scrubber units at a natural gas processing plant.

5.3.3. State Program Elements

State programs should contain mechanisms to encourage waste management consistent with the hierarchy of this section. A variety of mechanisms may be used, such as:

- a. Program requirements or policies that encourage source reduction and recycling;
- b. Improved training of state personnel so they can identify source reduction opportunities;
- c. Technical assistance or incentives to operators; and
- d. Educational activities aimed at informing facility operators of the options available.

The waste management hierarchy should be integrated into the other elements of a state program. For example, spill and release prevention should be incorporated into facility management regulations. Similarly, state requirements should address the segregation of waste streams that have a higher pollution potential from those with a lower pollution potential. State information program elements should include a component related to hierarchy planning and implementation.

State program planning activities should include goals and objectives that provide for substantial progress in this area over a reasonable time. States should have sufficient information to evaluate whether the mechanisms used to encourage source reduction and recycling are achieving those goals and objectives. State program requirements should be reviewed for consistency with the waste management hierarchy and the established goals and objectives. State agencies should also coordinate their efforts with other agencies that are responsible for waste management.

5.4. Quantitative Elements

Specific quantitative guidelines have been included for some waste management practices. The numbers cited are considered to be conservative values for protection of human health and the environment. However, they are not intended to be the basis for nationwide standards. Regulatory agencies may approve either less stringent or more stringent requirements where circumstances warrant as long as they afford the protection described in Section 5.1.a., and in the goals statement of Section 3.2.

5.5. Technical Criteria for Pits

5.5.1. Definitions

a. Reserve Pits

Pits used: (a) to store additional drilling fluids for use in drilling operations; and/or (b) to dispose of wastes generated by drilling operations and initial completion procedures.

b. Production Pits

- i. Skimming/Settling: Pits used to provide retention time for settling of solids and separation of residual oil.
- ii. Produced Water: Pits used for storage of produced water prior to injection for enhanced recovery or disposal, off-site transport, or surface-water discharge.
- iii. Percolation: Pits used to dispose of waste liquids via drainage or seepage through the bottom and/or sides of the pits into surrounding soils.

iv. Evaporation: Lined pits used to contain produced waters which evaporate into the atmosphere by natural thermal forces.

c. Special Purpose Pits

i. Blowdown: Pits used for collecting material resulting from the emptying or depressurization of wells or vessels.

ii. Flare Pits: Pits used exclusively for flaring gas.

iii. Emergency Pits: Pits used to contain liquids on a temporary basis due to process upset conditions.

iv. Basic Sediment: Lined pits used for temporary storage of production wastes from tank batteries or production vessels which may contain residual oil.

v. Workover: Pits used to contain liquids during the performance of remedial operations on a producing well in an effort to increase production.

5.5.2. Permitting

a. A permitting or review process should be in place for all pits. Pits may be authorized by rule, general permit, individual permit, or as a part of an operational permit or program.

b. Pits may be permitted by rule based upon specific requirements in areas where geologic, topographic, hydrologic or other conditions are similar.

c. Authorization for a pit may be included in operational, facility, or other environmental permits (e.g., drilling, workover, gas plant, NPDES discharge). The permit application process may have to be expanded to include certain additional information concerning the pit (i.e., intake volume, soil type, fluid makeup, topography, geology, hydrology, climatology, and such other factors as may be necessary to protect human health and the environment).

d. Construction and use of rule-authorized pits should require prior notification of the appropriate regulatory agency to ensure that proper construction, operation, and closure methods are used to protect human health and the environment.

- e. State programs should include provisions to accommodate approval of pits for emergency situations.

5.5.3 Construction

General standards for construction of pits should be included in area or statewide regulations and should address the following items:

- a. Size should be sufficient to ensure adequate storage until closure, taking into account historical precipitation patterns.
- b. Depth should be such that the bottom does not penetrate groundwater or such that the pit contents do not adversely impact groundwater or surface water. A review of available information or a study should be made of the area where the pit is to be located to determine if aquifers are present and should be protected.
- c. Berm height, slope, and material should be such that the pit is structurally sound and that pit integrity is not compromised by terrain or breached by heavy rains, winds, seepage, or other natural forces.
- d. If a salt section is anticipated or oil-based muds are used during a drilling program, reserve pits should be designed to accommodate those fluids.
- e. Construction standards for pits may differ depending upon the wastes they receive, the length of time they are used, and site-specific conditions.
 - i. The use of production pits is declining nationally because of concerns about potential contamination of air, soils, and groundwater. In many instances, equipment consolidation, process modifications, or tanks can be used in lieu of pits. The use of alternatives is generally encouraged. Where production pits are used, they should generally be lined, except as provided below in subsection 5.5.3.e.v.
 - ii. In the case of reserve and workover pits, liners should be required in certain instances based upon fluid type and site-specific characteristics (e.g., unconsolidated soils and/or hydro-geologic conditions that create a potential for adverse impact to surface water or groundwater, and proximity to environmentally sensitive areas).

- iii. Special purpose pits and other pits such as dehydration, tank drain, pipeline drip collector, and compressor scrubber pits should be lined.
 - iv. Blowdown, flare and emergency pits may be unlined where the removal requirement of Section 5.5.4.k. will prevent adverse groundwater quality impacts.
 - v. Variances to the above liner requirements should only be provided, and percolation pits should only be used, where it is clearly demonstrated there is minimal potential to affect adversely groundwater quality.
 - vi. Liners can consist of natural or synthetic materials, should meet accepted engineering practices, and should be compatible with expected pit contents.
- f. Requirements for fencing, netting, and caging, or any other method to secure a pit, should be set by area or statewide regulations, as necessary, to protect the public, domestic animals, and/or wildlife. Netting of a pit is recommended as the preferred method to protect wildlife in circumstances, among others, where pits have oil on the surface, where pits are used for long periods, and/or where pits are located in areas with arid climates.
- g. Where feasible, reserve pits should be placed to directly receive the discharge from solids separation equipment and to collect rigwash water, spills, and leaks from drilling equipment.

5.5.4. Operational Requirements

- a. Specific restrictions on the type of wastes that can be placed in the different types of pits should be included in area or statewide regulations. Restrictions should consider salinity, hydrocarbon content, pH, radionuclides associated with oil-field NORM, or other characteristics which may be detrimental to the environment.
- b. General security guidelines should protect the public, the environment, and wildlife.
- c. Liquids should be maintained at a freeboard level determined by the state that takes into account extreme precipitation events or other possibilities and prevents overtopping or un-permitted discharges.

- d. Lined pits should be operated in a manner that ensures liner integrity.
- e. Inspections and monitoring should be conducted at regular intervals or as necessary to ensure that pits meet all operating and structural integrity requirements and to ensure that pit contents do not adversely impact groundwater or surface water.
- f. Hydrocarbons which inadvertently accumulate in an unlined reserve pit should be skimmed off the pit at the cessation of drilling and completion operations.
- g. Separated oil or accumulated wastes should be periodically removed from unlined skimming/settling pits.
- h. Produced water pits should be used only for storage of produced water prior to injection or off-site transport.
- i. Percolation pits should be used only for disposal of produced waters and only when area or statewide restrictions established under Section 5.5.4.a. above are met.
- j. Evaporation pits should be periodically inspected for compliance with permitted input volumes and liner integrity. Evaporation pits should be skimmed as necessary to maintain an optimum evaporation rate.
- k. Blowdown, flare, and emergency pits should not be used for long-term storage or disposal. The regulatory agency should be notified promptly of the use of emergency pits. Fluids diverted to emergency pits should be removed as quickly as practical following the end of the emergency.
- l. Unlined basic sediment pits should not be used for storage of oily wastes; they should be replaced by lined pits or tanks.
- m. Workover pits should be open only for the duration of workover operations and should be closed within 120 days after workover operations are complete.
- n. Pit wastes that exhibit oilfield NORM above regulatory action levels should be managed in accordance with the criteria of Section 7 and any other applicable criteria of these guidelines.

5.5.5. Closure

- a. Pits should be closed in accordance with local, state, and federal regulations and, if on private property, consistent with lease obligations.
- b. Reserve pits should be closed as soon as practical but no later than 12 months after cessation of drilling operations. However, the closure of reserve pits beyond 12 months after cessation of drilling operations may be allowed in unusual circumstances if good cause can be demonstrated.
- c. Pit liquids should have free oil removed and, when appropriate, should be sampled prior to closure for salinity, hydrocarbon content, pH, radionuclides associated with oil-field NORM, or other characteristics which may be detrimental to the environment. On-site disposal of pit contents should be conducted in accordance with the landspreading, burial, and landfilling criteria of Sections 5.6. and 5.7, or by NPDES or UIC permit.
- d. Liquid and nonliquid materials not satisfying the on-site criteria for landspreading or burial (Sections 5.6. and 5.7.) should be disposed in federal or state approved disposal facilities.
- e. Pit sites should be capped, compacted, contoured, and vegetated where necessary, and in accordance with applicable state or area regulations to ensure ground support stability and to prevent erosion and ponding.
- f. Records should be permanently kept by the regulatory agency of all pit locations and should be available to the public for inspection and copying. A permit to drill may serve as adequate record keeping for the location of all pits within 200 feet of the well location.

5.6. Technical Criteria for Landspreading

5.6.1. Definition and Applicability

- a. Landspreading is a method of treatment and disposal of low toxicity wastes in which the wastes are spread upon and sometimes mixed into soils to promote reduction of organic constituents and the dilution and attenuation of metals. Landfarming or multiple applications are covered under Section 5.10.
- b. These criteria apply to waste disposal at or near E&P locations and

do not apply to commercial disposal operations. Commercial facilities used for disposal of E&P wastes are covered in Section 5.10.

- c. On-site landspreading of E&P wastes containing NORM above regulatory action levels should be prohibited.

5.6.2. Regulatory Requirements

When landspreading practices are used at E&P sites, they should be conducted consistent with local, state, and federal regulations, and lease and landowner obligations. General standards for landspreading should be included in area or state regulations and should address the operational requirements of Section 5.6.3.

5.6.3. Operational Requirements

- a. Free oil should be removed from the wastes by mechanical means such as skimming or filtration before the wastes are landspread.
- b. Landspread liquids should have a pH of 6 to 10 S.U. Where needed, liquids should be neutralized to obtain this range.
- c. Solid wastes should be spread evenly and disked into the soil.
- d. E&P wastes should be subject to loading rates, location restrictions, and/or other appropriate requirements that promote biodegradation of organic constituents; will not result in waste pooling, ponding, or runoff; will prevent the contamination of groundwater or surface waters; and will protect air quality.
- e. Where enhancement of biodegradation is desired, nitrogen and other nutrients should be added to the soil before disking. Nutrient application can be repeated over time.
- f. Amounts of waste added to soil during landspreading are generally limited by the electrical conductivity (EC), exchangeable sodium percentage (ESP), and sodium absorption ratio (SAR). The state should determine its criteria based on site-specific and waste-specific conditions. For example, some plants tolerate higher or lower salt levels, higher rainfall areas encourage salt movement out of the root-zone, or shallow groundwater may severely limit application.
- g. After landspreading of hydrocarbon containing waste, the waste-soil

mixture should not exceed one percent by weight oil and grease, unless the state regulatory agency approves a less or more stringent requirement where circumstances warrant.

- h. Salt- and hydrocarbon-loading criteria apply to the final waste-soil mixture and are not an application standard. The operator should be required to demonstrate that these criteria are met within 12 months of cessation of drilling or production. If these criteria are not met, remediation will be required. Nothing in this paragraph is intended to delay any requirement for erosion control and/or site reclamation or re-vegetation.
- i. Soil analyses should be performed prior to landspreading and again upon closure of the site. Upon site closure, waste constituents should not be present at levels that pose a significant risk to human health and the environment.
- j. Enhanced techniques, such as repetitive disking and nutrient addition, may be needed to meet the salt and hydrocarbon criteria of the final waste-soil mixture.
- k. Under special or abnormal conditions, additional limitations and analysis requirements should be considered for wastes that may contain toxic constituents derived from formation liquids, cuttings, drilling muds, or drilling-mud activities. Records should be permanently maintained by the agency of all waste analyses conducted pursuant to such additional requirements.

5.7. Technical Criteria for Burial and Landfilling

5.7.1. Definitions and Applicability

- a. Burial of wastes involves placing the wastes in an excavation and covering the wastes with a layer of soil.
- b. Landfilling of wastes involves placing the wastes on the ground and covering them with a layer of soil.
- c. These criteria apply to waste disposal at or near E&P sites and do not apply to commercial disposal facilities. Criteria for commercial disposal facilities are contained in Section 5.10.

5.7.2. Regulatory Requirements

When burial or landfilling is used at E&P sites, either should be

conducted consistent with lease and landowner obligations and with local, state, and federal regulations. General standards for burial or landfilling should be included in area or statewide regulations and should address the operational requirements in Section 5.7.3.

5.7.3. Operational Requirements

- a. Wastes or waste-soil mixtures may be buried or landfilled without a protective bottom liner only when they meet the landspreading criteria of Section 5.6. prior to burial. The contents of such waste or waste-soil mixtures should be limited to materials such as fresh water-based drilling muds, drill cuttings, spent iron sponge, gas plant catalyst, or molecular sieve. Closure should be consistent with Sections 5.5.5.a. and 5.5.5.e.
- b. A protective bottom liner, solidification, fixation, or encapsulation should be required for burial or landfilling of wastes whose salt and/or hydrocarbon content exceeds the landspreading criteria of Section 5.6.3. A protective bottom liner, solidification, fixation, or encapsulation should be required for burial or landfilling of E&P wastes containing NORM above regulatory action levels. The regulatory agency may grant a variance from this requirement for fields or portions of fields, upon a showing by the operator that groundwater either is not present beneath the waste site or is naturally protected from the threat of contamination.
- c. Agency records should be permanently maintained for any required analytical data taken, sites used, and types and quantities of waste disposed. Site locations should be located on plat maps.

5.8. Technical Criteria for Roadspreading

5.8.1. Definition

Roadspreading is the placement on roads of E&P wastes that exhibit properties similar to commercial road oils, mixes, dust suppressants, or road compaction or deicing materials. Roadspreading of E&P wastes that do not exhibit such properties should be prohibited. Roadspreading of E&P wastes containing NORM above regulatory action levels should be prohibited.

5.8.2. Regulatory Requirements

When roadspreading is used, it should be conducted consistent with

lease and landowner obligations and local, state, and federal regulations. General standards for roadspreading should be included in area or state regulations and address the operational requirements in Section 5.8.3.

5.8.3. Operational Requirements

- a. Exempt wastes such as tank bottoms, emulsions, heavy hydrocarbons, and crude oil-contaminated soil may be used for road oil, road mix, or asphalt if they are not ignitable and have a mixed density and metal content consistent with approved road oils or mixes.
- b. Roadspreading should be subject to loading rates and/or other appropriate requirements that prevent pooling, ponding, or runoff; prevent the contamination of groundwater and surface water; and protect air quality.
- c. Roadspreading should be subject to appropriate buffer zones established to protect waters of the state, water wells, and wetlands.
- d. Produced water should be tested and should exhibit properties similar to commercial roadspreading products that are regulated by federal, state, or local agencies.

5.9. Technical Criteria for Tanks

5.9.1. Scope

- a. This section applies to permanently installed E&P waste tanks and to produced water storage tanks located at enhanced recovery operations. Where some waste tanks are regulated under the Spill Prevention Control and Countermeasures (SPCC) requirements of the federal Clean Water Act, states may defer to the SPCC requirements for those tanks.
- b. Except as provided in Section 5.9.3.b., this section does not apply to:
 - i. condensate and crude oil tanks;
 - ii. process vessels, such as separators, heater treaters, dehydrators or freewater knockouts, except that stacks or vents on such

vessels should be equipped, where necessary, to protect migratory birds and other wildlife; and

iii. tanks used temporarily in drilling and workover operations.

c. The regulatory agency may adjust or exempt from the requirements of this section small-capacity tanks.

5.9.2. General Requirements

a. States should have information, where available, on the locations, use, capacity, age and construction materials (e.g., steel, fiberglass, etc.) of tanks as needed to administer and enforce state program requirements effectively. Such information may be obtained through registrations, inventories, or other appropriate means.

b. Tanks covered by this section should not be located in a flowing or intermittent stream and should be sited consistent with applicable local land-use requirements.

c. Tanks should be subject to spill-prevention, preventive maintenance and inspection requirements, including those of Sections 5.3.1.c. and 5.3.3. of these guidelines.

5.9.3. Construction and Operation Standards

a. A principal goal of construction and operation standards for tanks is to minimize the occurrence of and the environmental impacts from spills and leaks.

i. New tanks should be constructed in a manner that provides for corrosion protection consistent with the intended use of the tanks. All tanks covered by this section should be operated in a manner that provides for corrosion protection consistent with the use of the tanks.

ii. Tanks should exhibit structural integrity consistent with their intended use. Wooden tanks should receive increased scrutiny in this regard.

iii. Tanks should be operated in a manner that protects against overtopping.

iv. Secondary containment systems or other appropriate means, such

as leak detection, should be employed to minimize environmental impacts in the event of releases.

- b. Covered tanks are preferred to open tanks. Open E&P waste and product tanks should be equipped to protect migratory birds and other wildlife in a manner consistent with the wildlife-protection criterion of Section 5.5.3.f.
- c. Tanks located in populated areas where emissions of hydrogen sulfide can be expected should be equipped with appropriate warning devices.

5.9.4. Tank Removal and Closure

- a. Tanks should be emptied prior to their retirement and the resulting materials should be managed properly.
- b. Tanks and associated above ground equipment should be removed upon cessation of operations. For good cause, a state may allow tanks to be removed as soon as practical thereafter. Site reclamation should meet all landowner and lease obligations and any other applicable requirements.
- c. Prior to removal, closure, or release for unrestricted use, tanks and associated piping and equipment should be surveyed for NORM as provided for in Section 7. When regulatory action levels are exceeded, NORM and the equipment containing NORM should be managed in accordance with the state's NORM regulatory program (see Section 7 of these guidelines).

5.10. Technical Criteria for Commercial and Centralized Disposal Facilities

5.10.1. Definitions and Exemptions

- a. **Commercial Disposal Facility:** A facility whose owner(s) or operator(s) receives compensation from others for the temporary storage, reclamation, treatment, and/or disposal of produced water, drilling fluids, drilling cuttings, completion fluids, and any other RCRA exempt E&P waste, and whose primary business objective is to provide these services. These facilities may, under certain circumstances, also accept non-exempt, non-hazardous wastes generated from E&P operations. This definition also includes facilities whose owner(s) or operator(s) receives compensation from others for oil field NORM-related storage, decontamination, treatment, or disposal.

- b. Centralized Disposal Facility:** A facility, other than a commercial disposal facility, that is: (1) used exclusively by one owner or operator; or (2) used by more than one operator under an operating agreement and which receives for collection, treatment, temporary storage, and/or disposal of produced water, drilling fluids, drill cuttings, completion fluids, and any other RCRA exempt E&P wastes that are generated from two or more production units or areas or from a set of commonly owned or operated leases. These facilities may, under certain circumstances, also accept non-exempt, non-hazardous wastes generated from E&P operations. This definition covers the surface storage and disposal facilities that are present at Class II disposal well sites. This definition also covers oil field NORM related storage, decontamination, treatment, or disposal.
- c. Exemptions:** The definitions and technical criteria of Section 5.10 do not apply to Class II injection wells or to enhanced oil recovery projects. The definitions and technical criteria of Section 5.10 are not intended to apply to emergency cleanup situations at a Class II injection facility. The regulatory agency may adjust or exempt from the standards and requirements of this section (Sections 5.10), centralized facilities that receive a limited number of substantially similar waste streams and limited volumes of wastes, or commercial or centralized tank-only facilities.

5.10.2. Technical Standards and Regulatory Requirements

Commercial and centralized off-site disposal facilities should meet the technical and regulatory requirements of this section and the general standards of Section 5.1 of these criteria. Compliance with these requirements should be demonstrated in the permit application required in subsection 5.10.2.a. Because commercial disposal facilities use advanced methods of *waste* treatment and disposal, the regulatory agency should establish, where applicable, numerical requirements for the design of pond liners and leachate collection systems, for landfarming operations (i.e., repeated land applications), and for E&P waste reclamation facilities. The requirements of this section are intended to furnish the regulatory agency with sufficient and meaningful information such that permitting decisions will lead to no environmental impact or public health impact once the facility has commenced operations and following its closure.

The regulatory agency may adjust or exempt from these requirements centralized facilities that receive a limited number of substantially similar waste streams and limited volumes of waste, such as the

consolidated produced water disposal facilities in a large multi-operator field. Administrative criteria for centralized facilities also may be less extensive than those for commercial facilities.

5.10.2.1. Regulatory Agency Responsibilities in Permitting

- a. **Permits.** The regulatory agency should authorize off-site commercial and centralized disposal facilities for E&P wastes by permit. A permit should be in force for a finite period to be determined by the agency. The agency should use the data and information required by the technical standards of this section to approve or deny applications for permits, to ensure compliance with permit conditions, to order corrective actions in order to prevent or abate violations of the standards, or for any other purpose deemed necessary by the agency.
- b. **Acceptable Wastes.** The agency should prescribe the range of E&P wastes that can be disposed at commercial and centralized facilities and at municipal solid-waste landfills.
- c. **Waste Characteristics and Disposal.** The agency should identify the chemical characteristics of wastes likely to be disposed at commercial and centralized facilities on the basis of published scientific data and on knowledge about regional or site-specific waste characteristics. The agency should consider the types of waste management appropriate for each waste type, and the extent to which additional protective measures (e.g., leachate collection) are needed to protect groundwater, surface water and air. The agency should prescribe these waste disposal facilities and waste stream relationships by rule or in the permitting process and ensure that operators of commercial or centralized facilities comply with them. For sampling and testing, refer to Section 5.10.2.2.c.v. and vi. For determining radiological content, refer to Sections 7.3.3 and 5.2.2.b.

5.10.2.2. Permitting Requirements

- a. Any new or existing commercial or centralized facility should be required to obtain a permit from the regulatory agency to commence operation or to continue to operate. An individual permit should be required for E&P waste reclaimers and other commercial facilities where waste is placed on the land (e.g., in pits and in landfarms). A permit should be issued only upon compliance with the general requirements of Section 5.1 and the technical requirements of this section, and upon submittal and approval of an application that

contains a Siting Plan, Construction Plan, Operating Plan, and Closure Plan. Operation of a facility should comply with the terms and conditions of the permit. The regulatory agency may tailor the technical requirements for all existing facilities and for centralized disposal facilities to the conditions present at the locations of such facilities. In the case of centralized facilities, the regulatory agency may adjust the requirements of Section 5.10.2.2.a. b. and c. in the light of the volume and characteristics of wastes received by the facility.

- b.** Siting Plan. The specific site for a commercial facility and, to the extent possible, the site for a centralized facility, should have natural features that prevent or minimize release of pollutants to waters, land, and air. Those natural features could include isolation from or considerable depths to groundwater, protection against flooding, the presence of low permeability soils, and topography conducive to protection against erosion. Additional safeguards may be required by the regulatory agency for centralized facilities that are located on sites that do not exhibit natural protective features or are located in close proximity to residences, schools, hospitals or commercial buildings. An application for a permit for a commercial or centralized facility should, at a minimum, contain the following information:
 - i. Names, addresses, and telephone numbers of owner(s) and the operator(s) of the facility, the owner(s) and occupant(s) of properties within close proximity of the site, or any nearby person who may reasonably be adversely affected by release from the site;
 - ii. Topographic map showing the location of the site and any highways or roads that abut or traverse the site and depicting all water courses, flood plains, water wells, pipelines, and dwellings located within one mile of the site;
 - iii. Geologic, hydrologic, engineering, chemical, and any other data or information that demonstrate disposal of wastes and operation of the facility will not contaminate fresh water, the surrounding soils or air, endanger public health, safety or the environment, or cause property damage;
 - iv. Average annual precipitation and evaporation rate at the disposal site;
 - v. Nature and permeability of vadose zone; description of the

subsurface strata, identification of the areal extent of underlying aquifer(s), and depth to groundwater; direction of groundwater movement; baseline data on water quality of nearby surface waters, underlying aquifer(s) and soils prior to commencement of operations; and points of past or current use of surface water or groundwater;

- vi. Proof that all public notice requirements have been met; and
 - vii. Certification by an authorized representative of the applicant that information submitted in the application is true, accurate, and complete to the best of the applicant's knowledge.
- c. Construction Plan. In general, commercial and centralized disposal facilities should be constructed to prevent or minimize releases of wastes or waste byproducts to surface water, groundwater, soils, and air. Design should allow for the segregation, separation and containment of free oil to minimize emissions, where appropriate. The need for additional protective measures (e.g., barriers) at facilities in close proximity to residences, schools, hospitals, or commercial buildings should be considered. Pits at these facilities should at least meet the construction requirements of Section 5.5.3.e. In the case of E&P waste reclamation facilities, construction requirements to prevent or minimize releases should also apply to wastes stored before and after reclamation. For commercial facilities, detailed engineering drawings and diagrams of engineered disposal facilities should be required; for centralized or one-owner facilities, such extensive construction details may not be needed. Construction should follow guidelines and rules adopted by the regulatory agency.
- d. Operating Plan. Applications for permits for existing or new facilities should be accompanied by an Operating Plan that describes the wastes that will be accepted at the facility and the methods by which those wastes will be managed and disposed. The need for groundwater, air, or other monitoring at commercial or centralized disposal facilities where wastes are placed on the land should be evaluated by the state as part of this program development and implementation, and should depend upon the nature and size of the disposal activities. At facilities that manage oil-field NORM, monitoring should be sufficient to determine compliance with maximum permissible doses to workers and to members of the public in unrestricted areas. The Operating Plan should contain the following information:

- i. Volume, rate of application, and type of material to be disposed at the facilities and the facilities that will be used to dispose of each waste stream (i.e., unlined or lined pits, above- or below-grade tanks, etc.);
- ii. Contingency plan for reporting, responding to and cleaning up spills, leaks, and releases of wastes or waste byproducts, including provisions for notifying emergency response authorities and for taking operator-initiated emergency response actions;
- iii. Plan for routine inspection, maintenance, and monitoring to ensure and demonstrate compliance with permit requirements. At commercial and centralized facilities where wastes are placed on the land, such as in pits or landfarms, groundwater monitoring should be required in the absence of site-specific or facility-specific conditions that minimize the potential for adverse impacts to groundwater. Specific plans for preventing or minimizing air emissions from sources such as (1) the volatilization of organic materials in the waste; (2) particulate matter (dust) carried by the wind; and (3) chemical reactions (e.g., production of hydrogen sulfide from sulfur-bearing wastes) should be considered. Monitoring to ensure organic wastes are treated effectively should also be required for landfarming operations.
- iv. Waste acceptance policy for the facility that details the types of wastes that the facility will accept (exempt E&P wastes and/or non-exempt, non-hazardous wastes from E&P operations), how the facility will determine whether a shipment of wastes meets its acceptance criteria including whether on-site sampling and testing will be employed, and the procedures that will be followed if unacceptable wastes arrive at the facility;
- v. Plan to characterize wastes received for disposal. Waste characterization requirements for small centralized facilities may be more limited, based on the limited types and volumes of wastes received. At a minimum, waste characterization should comply with the requirements of Section 5.2. States should determine additional minimum testing criteria applicable to their regions;
- vi. Plan for periodic removal and subsequent handling of free oil;
- vii. Security plan for the facility;

- viii. In the case of landfarming operations, loading rates, location restrictions, and/or other appropriate requirements that ensure the treatment of organic constituents, prevent the contamination of groundwater or surface waters, and protect air quality. Operations should comply with the requirements of Section 5.6.3;
- ix. A community relations or public information plan should be considered; and
- x. Environmental, Health, and Safety Plan. Where applicable, an environmental, health, and safety plan should be developed for commercial disposal facilities. Such plan should describe site sampling methods and procedures to determine the potential risks to human health and the environment posed by the site. State regulatory programs should take into consideration the size and nature (treatment and disposal processes) of each facility when determining whether or not this environmental, health, and safety plan is applicable.

e. Closure Plan.

- i. Applications for permits for existing or new facilities should be accompanied by a Closure Plan that describes the methods to be used to reclaim the facility following the cessation of operations. Closure should comply with the general requirements of Section 5.1 and with any other requirements established by the regulatory agency.
- ii. For commercial disposal facilities and centralized disposal facilities of comparable nature or size, the plan should describe the site sampling methods that will be used to determine the risks to human health and the environment posed by the site, if any, once closure is completed; and any further measures that may be necessary to address remaining site contamination at that time. The plan should also include post-closure monitoring and maintenance requirements where the wastes remaining on-site after closure may adversely affect groundwater or surface waters, or otherwise pose a significant risk to human health and the environment. The duration of the post-closure care period and the nature of the post-closure requirements should correspond to the continuing risks posed by the facility after closure.
- iii. The plan should include a closure schedule, a cost estimate for reclamation, and a schedule for authorized financial assurance

instrument. The cost estimate and authorized financial assurance instrument schedule should be used to establish a financial surety level for the facility prior to permit approval. The level of financial surety requested should cover the full estimated cost of facility closure and reclamation.

5.10.2.3. Waste Tracking Requirements

To assure that only acceptable wastes are disposed of at commercial or centralized facilities, a waste tracking system that documents the movement of wastes from the site of their origin to their final disposition should be implemented. The following elements should be included in the waste tracking system:

- a. Multi-Part Form or Equivalent Documentation:** State regulatory programs should require operators to use a multi-part form or equivalent documentation that contains the names, addresses, and phone numbers of the generator (producer), hauler, and disposal facility operator; a description of the waste; the time and date it was collected, hauled, and deposited at the disposal facility; and the volume of the waste hauled.
- b. Maintenance of Waste Tracking Information:** The waste tracking information should be maintained by the generator, hauler, and operator of the disposal facility for inspection by the regulatory agency for a period of three years after the shipment date. This record retention period should be automatically extended for any person who is the subject of an unresolved enforcement action regarding the regulated activity from the date such person receives notice of the enforcement action until it is resolved.
- c. Attest to No Illegal Dumping:** The waste hauler should certify in writing that no unauthorized wastes were dumped illegally or at a location or facility not designated by the generator and that no unauthorized wastes were mixed with the exempt wastes during transport. The disposal facility operator should certify in writing that the facility is authorized to receive the waste for disposal.
- d. Reporting of Discrepancies:** The operator of the disposal facility should immediately report to the regulatory agency and the generator, any discrepancy in waste descriptions, volumes, or place of origin based on personal observations or documentation.
- e. Permitting of Waste Haulers:** Waste hauling companies should be

permitted by the regulatory agency based on a showing of basic knowledge about the regulatory requirements for disposition of E&P wastes transported from their point of generation to their final disposal site. The regulatory agency may issue permits to individual waste haulers or to waste hauling firms.

5.10.2.4. Applicability of Waste Tracking Criteria

These waste tracking requirements do not apply to wastes moved by pipeline. Operators who transport wastes by pipeline should periodically report waste quantities to the regulatory agency.

SECTION 6

ABANDONED SITES

6.1. Abandoned Oil and Gas Sites Introduction

States with current or historic oil and gas operations should develop and implement a program to inventory, prioritize, and remediate, as necessary, abandoned sites. The purpose of this section is to provide guidance for that program. It is not the intent of these guidelines to preclude an abandoned site from being returned to operation in accordance with state requirements.

6.2. Definition of "Oil and Gas Site" and "Abandoned Site"

The terms "Oil and Gas Site" and "Abandoned Site," as used herein, have the following meanings:

- a. An **Oil and Gas Site** is land or equipment, including a wellbore, that is now or has been used primarily for oil or gas exploration or production, or for the management of oil and gas wastes from exploration and production.
- b. An **Oil and Gas Site** is considered an **Abandoned Site** if the site:
 - i. Was not adequately plugged or closed at conclusion of operations such that it constitutes or may constitute a threat to public health or the environment; and
 - ii. Has no owner, operator, or other responsible person (hereinafter called "responsible party") who can be located, or such responsible party has failed or refused to undertake actions, where required by law, to abate the threat. A responsible party cannot be located, among other circumstances, where no liability for remedial actions is imposed by the state upon past or current owners and operators.

6.3. Identification of Abandoned Sites

A state should have a procedure for identifying sites which may constitute a threat to public health or the environment and for determining whether a responsible party exists. The state should develop and maintain an inventory of abandoned sites. Examples of elements that may be considered in identifying sites which may

constitute a threat to public health or the environment include agency reviews or inspections, referrals by other agencies, or citizen or landowner inquiries. Classifications or rankings may be used to separate these sites into relative risk categories. Examples of elements that may be considered in determining whether a responsible party exists include the failure to file required data or reports, the failure to respond to agency inquiries, tax defaults, information in public records, or landowner or public inquiries. In developing an inventory of abandoned sites, the state should have procedures for attempting to notify the last known responsible party, and providing legal notice.

Emergency protocols should be included, so that remedial action can be initiated prior to legal notice on sites that are judged to present an immediate threat to the public health or environment. Where there are agencies with overlapping jurisdiction for abandoned sites, inventory procedures should be coordinated among these agencies as further discussed in Section 4.4. of these guidelines.

6.4. Funding for Abandoned Site Remediation

An effective state program to address abandoned sites should have adequate funds available to permit the state to undertake any necessary assessment, plugging, closure, or remediation of such sites.

Adequate funding involves the development of a financial assurance program as provided in Section 4.2.4. To ensure the continuity of financial assurance in the event of a change of operator, notice to the state of any such change should be required. Any financial assurance provided by the previous operator should remain in effect until the new operator's compliance with the state's financial assurance program is verified.

Section 4.2.4. describes some of the types of financial assurance a state should consider in designing a program to provide it with the necessary economic resources while facilitating operator compliance. As part of a financial assurance program, a state should consider establishing a special purpose fund to plug, close, or remediate an abandoned site. The state should have the authority to recover costs from the responsible party, where such party exists. The state should evaluate its needs and establish such funding mechanisms as are appropriate to satisfy those needs. A wide variety of funding mechanisms have been employed to support existing special purpose funds in various states. Those mechanisms include bond forfeitures; legislative appropriations to the responsible state agency; a percentage

of the taxes on oil and gas production; fines and penalty assessments; equipment salvage; and a host of fees, among them fees or charges based on the value of oil and gas, fees or charges based on units of production of oil and gas, operator fees, supplemental fees in lieu of bonds, inactive well fees, permit fees, and waste generation fees.

6.5. Criteria for Prioritizing Remediation

The state program should include criteria for determining whether an abandoned site constitutes a threat to public health or the environment and the site's priority for remediation. Among other things, the following criteria may be used: (1) the occurrence of or potential for an imminent release from the site; (2) the nature, extent, and degree of contamination; (3) the proximity of the site to populated areas, surface water, and/or groundwater; (4) whether the site is in an environmentally sensitive area; and (5) wellbore lithology and condition. Where appropriate, the state should perform a more detailed site evaluation. The state agency should have flexibility and discretion to consider the factors associated with the individual sites, including cost savings associated with simultaneous remediation of multiple sites that otherwise would have different priorities or similar financial considerations, in assigning them a priority on the inventory of abandoned sites.

6.5.1. Goal for Remediation

A goal of the state program should be to remediate the abandoned sites on its inventory in a manner which assures that reasonable and measurable progress is made.

6.5.2. Liability for Remediation

The state should establish a liability scheme that will ensure that the goals of its abandoned sites program will be achieved. States should consider a range of options with respect to liability for remediation, which may include among others: (1) liability for all current and past owner(s) and operator(s); (2) liability for the owner(s) and operators(s) found to be responsible for the contamination at an abandoned site; or (3) no liability for past or current owner(s) and operator(s) should the state choose to finance the abandoned sites program.

Any liability scheme established by a state should clearly define the responsibility for remediation. A state should allow remediation of an abandoned site by a party which would not otherwise be responsible

for the remediation.

6.6. Standards for Remediation

The state should ensure that abandoned sites, including well bores, be plugged or closed in a cost-effective manner that minimizes or removes the threat to public health and the environment and that restores the land to an environmentally stable condition.

6.6.1. Well bore Remediation

The state should consider existing rules and regulations when determining proper plugging procedures for abandoned sites. However, the state should have the flexibility to modify those plugging procedures, while maintaining mechanical integrity of the well bore adequate to ensure that public health and the environment are protected.

In carrying out well bore remediation, the state should use existing information from well records including depth of well, depth of any old plugs, presence of casing and tubing and depths set, perforations, existence of groundwater and hydrocarbon-bearing zones, existence of over-pressured zones, and any junk in the hole to determine the condition of the well and the proper plugging procedure. In the absence of the above information, data such as existing geological and engineering field studies, water well records, interviews with nearby landowners, corporate records, and historical literature can be reviewed.

6.6.2. Site Remediation

The extent of surface remediation of an abandoned site should be determined based on surface and subsurface resources and land use. Consultation by the state regulatory agency with the surface owner, surface tenant, and other federal, state and local agencies, as appropriate, should take place prior to remediation.

As appropriate, abandoned sites should be re-vegetated in accordance with state regulatory agency rules, and with consideration given to recommendations from the surface owner, surface tenant, and federal and local agencies. As appropriate, soil should be evaluated to determine if hydrocarbons, chemicals, or NORM were spilled or leaked, and to determine remediation.

Surface equipment or materials on an abandoned site should be removed, and salvaged when possible, unless the state determines otherwise. Procedures should be identified for handling NORM, if present. Due to the expense and potential damage to the land, there may be situations where equipment or materials would not be removed, e.g., a gathering system might be abandoned in place with appropriate protection. When reclaiming a pit, the state should determine the contents of the pit and how the pit can best be remediated. Once emptied, cleaned and tested as appropriate, pits should be backfilled and contoured to prevent erosion from or ponding of surface water. Monitoring wells at an abandoned site should be as necessary to protect groundwater resources. The state should develop additional remediation criteria for commercial disposal sites, as appropriate.

6.6.3. Record of Remediation

Once remediation of an abandoned site has been completed, reports on how the site was remediated should be maintained by the regulatory agency.

6.7. Public Participation

The state abandoned sites program should provide for public participation. At a minimum, the public should have: (1) access to information about the program; (2) the opportunity to participate in any rulemakings associated with the program; and (3) a statutory or regulatory mechanism to petition the state agency to change a site's status on the inventory and/or the level of remediation required on a site.

6.7.1. Access to Information

The state should maintain and make available to the public, records related to the abandoned sites inventory, including: (1) the location of an abandoned site; (2) the extent and degree of contamination of the abandoned site; and (3) the method of remediation that has been or will be required for an abandoned site. In addition, the state should maintain public records on the state's progress with respect to implementing the abandoned sites program.

6.7.2. Participation in Rulemaking

The state program should provide an opportunity for the public to participate in any rulemakings associated with the program.

6.7.3. Participation Regarding Priority on the Inventory and Level of Remediation

The state program should include a mechanism by which an affected person could petition the state to: (1) add a site to the abandoned sites inventory; (2) change the priority for remediation of a site on the inventory; and (3) conduct or require additional remediation of a site.

6.8. Avoid Future Abandoned Site Problems

Since abandoned sites may constitute a threat to public health and the environment, the state should:

- a. Establish and implement an abandoned site program consistent with the guidance in this section; and
- b. Enforce its existing regulatory program, with modifications, if necessary, consistent with this guidance.
- c. Evaluate its programs for financial assurance, inspection, compliance tracking, and monitoring of inactive sites to determine whether or not the state should make adjustments to prevent an increase in abandoned sites.

SECTION 7

NATURALLY OCCURRING RADIOACTIVE MATERIALS

7.1. Background

Naturally occurring radioactive material (NORM) is present above background levels at some oil and gas E&P facilities and oil-field service company locations. NORM found in oil-field operations originates in subsurface oil and gas formations and is typically transported to the surface in produced waters. NORM may deposit in well tubulars, surface piping, vessels, tanks, pumps, valves, and other producing or processing equipment and may be found in scales, sludges, contaminated soil, and other associated E&P wastes. NORM is also referred to as Technologically Enhanced Naturally Occurring Radioactive Material or TENORM.

7.2. General

States should adopt an oil field NORM regulatory program that addresses identification, use, possession, transport, storage, transfer, decontamination, and disposal to protect human health and the environment. States may choose not to adopt such a program if they find, based on field monitoring data and other scientific information, that no NORM is present in oil and gas operations in the State, or that the levels of NORM present in oil and gas operations in the State do not present such a risk to human health or the environment to warrant a regulatory program. States that make such a finding should periodically reevaluate the basis for the determinations.

If a state determines that a regulatory program is necessary, it should tailor its program to NORM occurrence in the oil and gas E&P industry and an assessment of risks to human health and the environment. The program should include the elements listed in Section 7.3. Oil-field NORM should be managed in accordance with the pollution prevention and waste management hierarchy provisions of these guidelines. In addition, the other sections of these guidelines apply, where applicable, to NORM as a constituent of E&P waste.

7.3. Elements of an Oil-Field NORM Program

7.3.1. Definition

States should develop a definition for NORM that is consistent with that

which occurs in the oil and gas E&P industry. For purposes of these guidelines, NORM is defined as any naturally occurring radioactive materials (not including byproduct, source or special nuclear material, or low level radioactive waste) not subject to regulation under the Atomic Energy Act, whose radionuclide concentrations have been enhanced by human activities such that potential risk to human health or the environment are increased.

7.3.2. Action Levels

States should establish risk-based numerical action levels above which NORM is regulated taking into consideration the risk of exposure to human health and the environment. Such action levels should also be used to regulate the transfer or release of equipment, materials, and sites.

7.3.3. Surveys

States should develop standards for survey instruments and procedures for identifying and documenting equipment, materials, and sites that may contain NORM above the action levels. States should consider the types of facilities to be surveyed, when surveys should be performed, when survey results should be reported to the state regulatory agency, and any necessary training of surveyors. State survey requirements should provide data necessary to meet the purposes described in Section 5.2.1 and to administer and enforce state program requirements effectively.

7.3.4. Worker Protection

State regulatory programs should include applicable state and federal standards for worker protection from exposure to radiation, including worker protection plans, and other standards necessary for the protection of workers from exposure to NORM. States should establish NORM training or certification requirements based upon oil-field work related duties and their associated NORM exposure risk (i.e., NORM awareness training may be sufficient for many common oil-field work activities).

7.3.5. Licensing/Permitting

- a. General licensing/permitting: Persons who possess oil-field NORM in concentrations or at exposure rates that exceed state-adopted action levels should be generally licensed or permitted.

- b. Specific licensing/permitting: Specific licenses or individual permits should be required for commercial storage, removal, decontamination, remediation, treatment or disposal of oil-field NORM. A state may require specific licenses or individual permits for the management of oil-field NORM at centralized facilities as defined in Section 5.10.

7.3.6. Removal/Remediation

States should consider performance standards for removal, decontamination, and remediation that are protective of human health and the environment.

7.3.7. Storage

States should establish standards for storage of NORM that are protective of human health and the environment. NORM storage facilities should be constructed to prevent or minimize releases. Tanks used to store oil-field NORM should meet the requirements of Section 5.9. A state should consider adoption of limits on the amount of time NORM that exceeds action levels can be stored, depending on factors such as quantity, radioactivity, climate, proximity to the public, and protective controls.

7.3.8. Transfer for Continued Use

State regulatory programs should allow for the transfer of land and equipment containing NORM for continued operations in the production of crude oil and natural gas, with appropriate notification to affected parties.

7.3.9. Release of Sites, Materials, and Equipment

State regulatory programs should address the levels below which, and conditions under which, equipment, materials, and sites containing NORM may be released. State regulatory programs should authorize the release of equipment, materials, and sites for unrestricted use only if NORM is below action levels. Such regulations should provide for appropriate notification to affected persons.

7.3.10. Disposal

State regulatory programs should authorize disposal alternatives within

the state's jurisdiction for various E&P wastes containing NORM, including contaminated equipment, and should include regulatory requirements for NORM disposal that are protective of human health and the environment. Landowner or other notification may be required as a condition of disposal. Commercial and centralized NORM disposal facilities should meet the criteria of Section 5.10.

7.3.11. Interagency Coordination

State radiation programs, oil and gas programs, and waste management programs are frequently distributed among separate agencies. Therefore, in many states, multiple agencies may regulate NORM. The various agencies should coordinate their regulatory and enforcement activities under the guidance given in Section 4.4 of these guidelines.

7.3.12. Public Participation

State regulatory programs for NORM should meet the public participation guidelines established in Section 4.2.2.

7.4. Regulatory Development and Research

The Conference of Radiation Control Program Directors has prepared suggested state regulations for NORM, and a number of states have developed or are in the process of developing NORM regulations. States that are developing their own NORM programs are encouraged to consult these sources as well as applicable federal radiation guidance and requirements for information and assistance. In addition, states should encourage and keep abreast of ongoing and future research on NORM, including risk assessment.

SECTION 8

STORMWATER MANAGEMENT

8.1. General

States usually have statutory authority for stormwater management through general pollution prevention or water pollution control legislation. States should implement programs to minimize the potential for contamination of surface water from sediment and other E&P contaminants contained in stormwater. The state program need not duplicate applicable federal regulations for stormwater management.

States may choose not to adopt such a program if they find, based on scientific information, such as surface water monitoring data, that stormwater runoff does not pose a significant risk to human health or the environment. States that make such a finding should periodically reevaluate the basis for the determination.

Stormwater management requirements should be adapted to regional characteristics. These characteristics include variations in topography, rainfall (annual average, episodic and seasonal), major soil types, proximity to surface waters, floodplains, seasonal and permanent swamps, wetlands and marshes, and vegetative cover.

8.2. State Program Elements

8.2.1. Regulatory Approach

State programs should encourage the use of best management practices for erosion control and stormwater management and should require an operator to minimize environmental impacts caused by stormwater. These requirements should include a description of the actions the operator will take to meet state program goals. These requirements may be spelled out in specific regulations or they may be required to be included in operator- or site-specific plans developed by operators. State program requirements should specify time frames when stormwater control measures are to be in place and when any state notification is to occur.

In regions where stormwater has a high potential for causing environmental degradation, states should consider the use of permits or other authorizations to assure that adequate measures will be put in place. Such permits or authorizations should conform to Section 4.1.1. (Permitting).

8.2.2. Compliance Assurance

State stormwater management programs should contain compliance evaluation capabilities as outlined in Section 4.1.2. (Compliance Evaluation), contain enforcement capabilities as outlined in Section 4.1.3. (Enforcement), be applicable to responses to spills and releases as outlined in Section 4.2.1. (Contingency Planning and Spill Risk Management), and contain data management capabilities as described in Section 4.2.8. (Data Management).

8.2.3. Outreach and Training

State programs should provide for outreach and training on stormwater management requirements and practices for operators, landowners and the public. These activities should conform to Section 4.2.2.2. (Public Participation). Similarly, training should be provided for state agency personnel as outlined in Section 4.3.1.5. (Training Requirements). Where stormwater management and E&P regulatory authority reside in different agencies, oil and gas agency staff should be trained so that they can, as time and staffing patterns allow, provide information and referrals to operators.

8.2.4 Program Evaluation

State stormwater management programs should be evaluated periodically in accordance with Section 4.2.3 (Program Planning and Evaluation). Such evaluations should include an analysis of all aspects of the program, and procedures for making any necessary program changes identified during the evaluation.

8.3. State Program Criteria

8.3.1. Construction

8.3.1.1. Activities Covered

The construction of well sites, access roads, pipelines, stream crossings and crossings of wetlands, swamps and marshes can result in the contamination of stormwater and/or adjacent surface waters. Consequently, state stormwater management programs should include standards or management practices appropriate for these activities. Similar practices may be necessary when responding to spills and releases when soils are disturbed or contaminants are mobilized by stormwater.

8.3.1.2. Examples of Appropriate Practices

Standards or management practices should be appropriate for the region in which the construction activity will occur. Examples of such requirements include the construction of upgrade diversion channels and the collection of construction site runoff; the use of brush and other barriers and the stockpiling of topsoil and subsoil during clearing and grubbing; and the grading of cut and fill slopes, road embankments, road surfaces (crowned, in-sloping or out-sloping) and roadside ditches to control water.

Similarly, state programs should include requirements for bridges, causeways, cofferdams, fords and bank stabilization when surface waters are encountered. Requirements for temporary road or stream crossings and use of rock at construction entrances may be necessary.

Practices to be considered for stormwater controls during construction include drainage ditches, basins, sediment traps, berms, vegetative filter strips, sediment barriers, turnouts, culverts and cross-drains, broad-based dips and swales, waterbars, rock filters, straw bale barriers and fabric filter fence. Outlet protection such as secondary filtration or settlement should be provided when necessary prior to discharge to surface waters.

Additional practices to be considered for pipeline construction include the use of ditchline barriers, timing of backfilling, materials used for trench backfill, location of staging areas, and the use of trench plugs. In fragile soil, wetland and marshy areas, and at stream crossings, construction mats, board roads or geo-textiles should be considered.

8.3.1.3. Temporary/Permanent Stabilization

A state program should include criteria for temporary stabilization if permanent stabilization will be delayed. Temporary stabilization practices such as seeding with annual grasses and mulching, or seed/filter fabric combinations should be considered.

Permanent stabilization can occur through the application of rock to well sites and roads, and achieving adequate growth of (or sodding with) permanent vegetation. Factors to be considered during revegetation include calculation of acreage, soil types and distribution, seed bed preparation, seed mixtures (temporary, permanent), soil amendments, and mulching and anchoring.

8.3.2. Operation and Maintenance

State programs should require that stormwater control measures be operated and maintained in a manner that will assure their effectiveness during site preparation, well drilling and production, and until the site is restored. These measures should be operated and maintained to control sediment as well as E&P waste and spills. Requirements regarding the frequency and type of inspection, preventative maintenance and repairs are appropriate.

8.3.3. Restoration and Reclamation

Where appropriate, states should incorporate stormwater management during the development of standards for site restoration and reclamation. These requirements should apply to the restoration of recently inactivated sites, orphan sites, remediation sites, and sites where prior restoration efforts failed.

Where appropriate, stormwater management criteria should be developed for the removal of equipment, restoration of pits, disconnection and abandonment of pipelines, backfilling and grading, and access road reclamation.

SECTION 9

RECOMMENDATIONS FOR FUTURE WORK

1. Industry, the federal government, state-affiliated academic institutions, and public-interest groups are encouraged to conduct and support research effective ways of minimizing and reusing wastes generated in the nation's oil and gas fields.
2. EPA is urged to continue to support and work with IOGCC, STRONGER, and all interested parties in advancing the state review process.
3. While these guidelines expressly provide for the protection of air quality, few specifics are now included in this area. Accordingly, these guidelines will continue to be reviewed for possible additional air quality recommendations.
4. These guidelines should be updated as state reviews progress and additional information and experience is gained in their application.

SECTION 10

REFERENCES

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APPENDIX A

GLOSSARY OF TERMS

The following is a glossary of selected terms used in the Interstate Oil and Gas Compact Commission Environmental Guidelines for State Oil and Gas Regulatory Programs. The glossary is included only as an aid for the convenience of the reader. It is not intended as an exhaustive compilation of the terms used in the Report, nor are the definitions set forth intended to be preclusive of other potential meanings. Terms expressly defined in the text of the Report are not included in this glossary.

A

Acid: A chemical compound, one element of which is hydrogen, that dissociates in solution to produce free-hydrogen ions. For example, hydrochloric acid, HCl, dissociates in water to produce hydrogen ions - H⁺, and chloride ions, Cl⁻.

Aquifer: A geological formation, group of formations, or part of a formation that is capable of yielding water to a well or spring.

B

Barrel: A measure of volume for petroleum products. One barrel is equivalent to 42 U.S. gallons.

Basic Sediment and Water (BS&W): The water and other extraneous material present in crude oil.

Biodegradation: The process of breaking down matter into innocuous products by the action of living things, such as microorganisms.

Blowdown: The material discarded as a result of depressurizing a vessel or well.

Brackish Water: Water that contains relatively low concentrations of soluble solids. Brackish water has more total dissolved solids than fresh water, but considerably less than sea water.

Brine: Water that has a large quantity of salt, especially sodium chloride, dissolved in it; salt water and certain produced water are considered brines.

C

Characteristic Waste: Waste that is considered hazardous under RCRA because it exhibits any of four different properties: ignitability, corrosivity, reactivity, and toxicity.

Clean Air Act (CAA): The act that regulates air emissions from area, stationary, and mobile sources. CAA limits the emission of pollutants into the atmosphere in order to protect human health and the environment from the effects of airborne pollution.

Clean Water Act (CWA): The act that sets the basic structure for regulating discharges of pollutants to surface waters of the United States. CWA imposes contaminant limitations or guidelines for all discharges of wastewater into the nation's waterways.

Climatology: The science that deals with climates (the prevailing influence or environmental conditions characterizing a group or period) and their phenomena.

Completion Fluid: A special fluid used when a well is being completed. It is selected, not only for its ability to control formation pressure, but also for its properties that minimize formation damage.

Completion Operations: Work performed in an oil or gas well after the well has been drilled to total depth. This work includes, but is not limited to, setting the casing, perforating, artificial stimulation, production testing, and equipping the well for production, all prior to the commencement of the actual production of oil or gas in paying quantities, or in the case of an injection or service well, prior to when the well is plugged and abandoned.

Corrosivity: The characteristic which identifies wastes that are acidic or basic (alkaline) and can readily corrode or dissolve flesh, metal, or other materials. The hazardous characteristic of corrosivity, for purposes of RCRA, is defined in 40 CFR 261.22, and generally includes aqueous solutions with a pH less than or equal to 2.0, or greater than or equal to 12.5, and/or liquids which corrode SAE 1020 steel at a rate greater than or equal to 6.35 mm per year.

Crude Oil: Unrefined liquid petroleum. It ranges in gravity from 9 to 55 API and in color from yellow to black, and it may have a paraffin, asphalt, or mixed base. If a crude oil, or crude, contains a sizable amount of sulfur or sulfur compounds, it is called a sour crude; if it has little or no sulfur, it is

called a sweet crude. In addition, crude oils may be referred to as heavy or light according to API gravity, the lighter oils having the higher gravities.

D

De-listing: A site-specific petition process whereby a handler can demonstrate to EPA that a particular waste stream generated at its facility that meets a listing description does not pose sufficient hazard to warrant RCRA regulation. Owners and operators can also use the de-listing process for wastes that are hazardous under the mixture and derived-from rules that pose minimal hazard to human health and the environment.

Derived-from Rule: A rule that regulates residues from the treatment of listed hazardous wastes. This rule is found at 40 CFR 261.3.

Disking: The process of using a tractor-pulled set of disks to mix surface soil with waste for the purpose of treating and/or disposing of E&P wastes.

Disposal Well: A Class II well permitted under the SDWA which is employed for the injection of produced water and certain other E&P wastes into an underground formation.

Drill Cutting: The formation rock fragments that are created by the drill bit during the drilling process.

Drilling Fluid: The circulating fluid used in the rotary drilling of wells to clean and condition the hole and to counterbalance formation pressure. Drilling fluids are circulated down the drill pipe and back up the hole between the drill pipe and the walls of the hole usually to a surface tank. Drilling fluids are used to lubricate the drill bit, to lift cuttings, to seal off porous zones, and to prevent blowouts. A water-based drilling fluid is the conventional drilling mud in which water is the continuous phase and the suspended medium for solids, whether or not oil is present. An oil-based drilling fluid has diesel, crude, or some other oil as its continuous phase, with water as the dispersed phase. Synthetic drilling fluid has a synthetic material such as esters or olefins as the continuous phase and water as the dispersed phase. In some circumstances air or another gas is used as a drilling medium.

E

Electrical Conductivity (EC): A numerical expression of the ability of a material to carry a current; the reciprocal of resistivity; normally expressed in

milliohm/meter. It is frequently used in soil analysis to evaluate a soil's ability to sustain plant growth.

Emulsion: A mixture in which a liquid, termed the dispersed phase, is uniformly distributed (usually as minute globules) in another liquid, called the continuous phase or dispersion medium. In an oil-water emulsion, the oil is the dispersed phase and the water the dispersion medium; in a water-oil emulsion, the reverse holds. For example, emulsions occur during production processes where crude oil is prepared for pipeline transportation.

Exploration: The search for reservoirs of oil and gas, including aerial and geophysical surveys, geological studies, core testing, and the drilling of exploratory wells, also known as wildcats.

Exchangeable Sodium Percentage (ESP): The extent to which the absorption complex of a soil is occupied by sodium.

$$\text{ESP} = \frac{\text{exchangeable sodium}}{\text{cation exchange capacity}} \times 100$$

Where the units for both the numerator and denominator are in milliequivalents per 100 grams of soil.

F

Field: A geographic area in which a number of oil or gas wells produce from a continuous reservoir. A field may refer to surface area only or to underground productive formations as well. In a single field, there may be several separate reservoirs at varying depths.

Formation: A bed or deposit composed throughout substantially the same kinds of rock; a lithologic unit. Each different formation is given a name, frequently as a result of the study of the formation outcrop at the surface and sometimes based on fossils found in the formation, and is sometimes based on electric or other bore-hole log characteristics.

Formation Water: The original water in place in a formation at the time production commences.

Fracturing: A method of stimulating production by increasing the permeability of the producing formation. Under hydraulic pressure, a fluid is pumped down the well and out into the formation. The fluid enters the formation and parts or fractures it.

Fracturing Fluids: The fluids used to hydraulically fracture a rock formation. In some cases, a proppant is deposited in the fractures by the fracturing fluid, which is subsequently pumped out and recovered.

G

Gas Processing Plant: A plant for the processing of natural gas, by other than solely mechanical means, for the extraction of natural gas liquids, and/or the fractionation of the liquids into natural gas liquid products such as ethane, butane, propane, and natural gasoline.

Gas Treating Plant: A plant for the purification of natural gas (e.g., the removal of water and/or acid gases such as hydrogen sulfide) and recovery of condensate.

Generator: Any person whose act first creates or produces a waste.

Groundwater: Water below the land surface where there is sufficient water present to completely saturate the soil or rock.

Groundwater Monitoring: Sampling and analysis of groundwater for the purpose of detecting the release of contaminants.

H

Hazardous Waste: A waste with properties that make it dangerous or capable of having a harmful effect on human health and the environment. Under the RCRA program, hazardous wastes are specifically defined as wastes that meet a particular listing description or that exhibit a characteristic of hazardous waste.

Hydrocarbon: Organic compound of hydrogen and carbon, whose densities, boiling points, and freezing points increase as their molecular weights increase. Although composed of only two elements, hydrocarbons exist in a variety of compounds because of the strong affinity of the carbon atom for other atoms and for itself. The smallest molecules of hydrocarbons are gaseous; the largest are solid.

I

Ignitability (RCRA): The characteristic which identifies wastes that can readily catch fire and sustain combustion. The hazardous characteristic of ignitability for purposes of RCRA is defined in 40 CFR 261.21 and is

generally a liquid with a flash point less than 140 F., a non-liquid that causes fire under a friction condition, an ignitable compressed gas, or is an oxidizer.

L

Land Disposal: For purposes of RCRA Subtitle C regulation, placement in or on the land, except in a corrective action unit, and includes, but is not limited to, placement in a landfill, surface impoundment, waste pile, injection well, land treatment facility, salt dome formation, salt bed formation, underground mine or cave, or placement in a concrete vault or bunker intended for disposal purposes.

Landfill: For purposes of RCRA Subtitle C, a disposal unit where non-liquid hazardous waste is placed in or on the land.

Lease: A legal document executed between a landowner (or a lessor) and a company or individual as lessee, that grants the right to exploit the premises for minerals or other products. The lease is sometimes referred to as the area where production wells, stock tanks, separators, and production equipment are located.

Liner: Continuous layer of natural or synthetic materials, beneath and on the sides of a surface impoundment, landfill, or landfill cell, which restricts the downward or lateral escape of waste, waste constituents, or leachate.

Listed wastes: Wastes that are considered hazardous under RCRA because they meet specific listing descriptions.

Loading Criteria: A numeric level, normally expressed in pounds per acre, below which a specific chemical compound may be applied to the soil.

Location: Place at which a well is to be or has been drilled.

M

Mixture Rule: A rule that is intended to ensure the regulation of mixture of listed wastes with non-hazardous solid wastes.

Molecular Sieve: Absorbents that are used to remove small amounts of H₂S and/or water from natural gas, capable of being regenerated.

Municipal Solid Waste: Durable goods (e.g. appliances, tires, batteries), non-durable goods (e.g. newspapers, books, magazines), containers and

packaging, food wastes, yard trimmings, and miscellaneous organic wastes from residential, commercial and industrial non-process sources.

N

Natural Gas: Naturally occurring mixture of hydrocarbon and non-hydrocarbon gases found in geologic formations beneath the earth's surface. The principal hydrocarbon constituent is methane.

O

Operator: The person or company, either proprietor, contractor, or lessee, actually operating a well, lease, or disposal facility.

P

Permeability: The ability of a formation to transmit fluids.

pH: A measure of acidity or alkalinity of a solution, numerically equal to 7 for neutral solutions, increasing with increasing alkalinity and decreasing with increasing acidity.

Plug and Abandon (P&A or Plugging): The placement into a well of a plug or plugs designed to restrict the vertical movement of fluids after abandonment.

Produced Sand: The formation solids which flow into the wellbore with the produced formation fluids. In general, the lower the formation competency, the greater the produced sand volumes.

Produced Water: The fluid brought up from the hydrocarbon-bearing strata during the extraction of oil or gas. It can include formation water, injection water, and any chemicals added downhole or during the oil/water separation process.

Production: The phase of the petroleum industry that deals with bringing the well-fluids to the surface and separating them, and with storing, gauging, and otherwise preparing the product for sale.

R

Reactivity: The characteristic identifying wastes that readily explode or undergo violent reactions. The hazardous characteristic of reactivity for purposes of RCRA is defined in 40 CFR 261.23 and generally includes

wastes with highly exothermic reactions or wastes which create toxic gases when mixed with water.

Reclaimed: For purposes of defining a material as a solid waste under RCRA Subtitle C, a material is reclaimed if it is processed to recover a usable product, or regenerated by processing it in a way that restores it to usable condition.

Reclamation: The process of returning a site or contaminated soil to an appropriate state of environmental acceptability.

Recycled: For purposes of defining a material as a solid waste under RCRA Subtitle C, a material is recycled if it is used or reused, or reclaimed.

Recycling: The separation and collection of wastes, their subsequent transformation or remanufacture into usable or marketable products or materials, and the purchase of products made from recyclable materials.

Reservoir: A subsurface, porous, permeable rock body in which oil or gas or both are stored. Most reservoir rocks are limestones, dolomites, sandstones, or a combination of these. The three basic types of hydrocarbon reservoirs are oil, gas, and condensate. An oil reservoir generally contains three fluids; gas, oil, and water-with-oil, the dominant product. In the typical oil reservoir, these fluids occur in different phases because of the variance in their gravities. Gas, the lightest, occupies the upper part of the reservoir rocks; water, the lower part; and oil, the intermediate section. In addition to occurring as a cap or in solution, gas may accumulate independently of the oil; if so, the reservoir is called a gas reservoir. Associated with the gas, in most instances, are salt water and some oil. In a condensate reservoir, the hydrocarbons may exist as a gas, but when brought to the surface, some of the heavier constituents condense to a liquid or condensate. At the surface, the hydrocarbons from a condensate reservoir consist of gas and a high-gravity crude (i.e., the condensate). Condensate wells are sometimes called gas-condensate reservoirs.

S

Safe Drinking Water Act (SDWA): The act designed to protect the nation's drinking water supply by establishing national drinking water standards (maximum contaminant levels, (MCL's), or specific treatment techniques), and by regulating UIC wells.

Salinity: The quantitative level of salt in an aqueous medium.

Salt Section: A formation, or part of a formation, which is predominately made up of salt; typically sodium chloride.

Sodium Absorption Ratio (SAR): A ratio of the concentration of sodium to the square root of the sum of the concentrations of calcium and magnesium.

$$SAR = \frac{Na^+}{\sqrt{Ca^{2+} + Mg^{2+}}}$$

Where the cation concentrations are in millimoles per liter. It is a measurement frequently used in soil analysis to evaluate a soil's ability to sustain plant growth.

Solid Waste: Any garbage; refuse; sludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility; and other discarded material, including solid, liquid, semisolid or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations and from community activities. For the purposes of hazardous waste regulation, a solid waste is a material that is discarded by being either abandoned, inherently waste-like, a certain waste military munition, or recycled.

Solids Separation Equipment: Equipment used in drilling and workover/completion operations to remove drill cutting or formation solids from the drilling or workover/completion fluid. May include liquid/solids separation devices such as shale shakers, hydrocyclones, centrifuges, and filtration units.

SPCC: Spill prevention Control and Countermeasures. Regulations establishing spill prevention procedures and equipment requirements for non-transportation related facilities with certain above-ground or underground storage capacities (e.g., crude oil tanks) that could reasonably be expected to discharge oil into or upon the navigable waters of the United States or adjoining shorelines.

Spent Materials: Materials that have been used and can no longer serve the purpose for which they were produced without processing.

Subtitle C: That portion of the Resource Conservation and Recovery Act (RCRA) which defines and legislates the management of hazardous wastes.

Tank Bottoms: Produced sand, formation solids, and/or emulsions that settle-out in production operation process vessels.

Topography: The physical features of a district or region, such as are represented on maps, taken collectively; especially the relief and contour of the land.

Toxicity: The characteristic which identifies wastes that are likely to leak dangerous concentrations of toxic chemicals into groundwater. The hazardous characteristic of toxicity for purposes of RCRA is defined in 40 CFR 261.24 and includes eight metal and thirty-one organic compounds. The toxicity characteristic is determined in accordance with a prescribed test procedure (the toxicity characteristic leaching procedure -TCLP).

Toxicity Characteristic Leaching Procedure (TCLP): A lab procedure designed to predict whether a particular waste is likely to leach chemicals into groundwater at dangerous levels.

Transporter: A person engaged in the off-site transportation of waste.

Treatment: Any method, technique, or process designed to physically, chemically, or biologically change the nature of a hazardous waste.

Treatment, Storage and Disposal Facilities: Facilities engaged in the treatment, storage, or disposal of hazardous waste. These facilities are the last link in the cradle-to-grave hazardous waste management system.

U

Underground Source of Drinking Water (USDW): An aquifer which supplies drinking water for human consumption or for any public water system, or contains fewer than 10,000 mg per liter total dissolved solids, and does not contain minerals or hydrocarbons that are commercially producible, and is situated at a depth or location which makes the recovery of water for drinking water purposes economically or technologically practical. While EPA defines an USDW as containing less than 10,000 mg per liter TDS, certain states, such as California and Texas, have adopted a 3,000 mg per liter TDS definition for the Class II UIC injection well programs.

Universal Wastes: Commonly referred to as recycled wastes with special management provisions intended to facilitate recycling. There are three categories of universal wastes; hazardous waste batteries; hazardous waste pesticides that have been recalled or collected in waste pesticide collection programs; and hazardous waste thermostats.

Used Oil: Any oil that has been refined from crude or synthetic oil that has been used, and as a result of such use, is contaminated by physical or chemical impurities.

V

Vadose Zone: A subsurface soil zone that contains suspended water. The vadose zone is above the zone of continuous water saturation.

W

Waste Minimization: The reduction, to the extent feasible, in the amount of waste generated prior to any treatment, storage, or disposal of the waste. Because waste minimization efforts eliminate waste before it is generated, disposal costs may be reduced, and the impact on the environment may be lessened.

Waterflood: A method used to enhance oil recovery in which water is injected into a reservoir to remove additional quantities of oil that have been left behind after the primary recovery. Usually, a waterflood involves the injection of water into strategically placed wells so that it sweeps through the reservoir and moves remaining oil to the producing wells.

Workover: One or more of a variety of remedial operations performed on a producing well to try to increase production. Examples of workover operations are deepening, plugging back, pulling and resetting the liner, squeeze-cementing, perforating additional horizons, etc.

Workover Fluid: A special fluid used to keep a well under control when it is being worked over. A workover fluid is composed carefully so it will not cause formation damage. Also used to stimulate a well to enhance productive capacity such as a frac fluid, acid, etc.

Workover Wastes: Wastes resulting from well workover operations. The wastes usually include workover fluids, similar to drilling fluids and could include various small volume wastes such as tubing scale, wax/paraffin, and cleaning or painting wastes.